

**TECHNICAL MANUAL
FOR
NAVY SHIPBOARD
COLLECTIVE PROTECTION SYSTEM
(CPS)**

**SYSTEM DESCRIPTION,
OPERATION AND MAINTENANCE**



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PUBLISHED BY DIRECTION OF COMMANDER, NAVAL SEA SYSTEMS COMMAND

NAVSEA TECHNICAL MANUAL CERTIFICATION SHEET					_ 1 _ of _ 1 _
Certification Applies to:		New Manual	<input checked="" type="checkbox"/> Revision	Change	
Applicable TMINS/Pub No.		SS200-AF-MMM-010			
Publication Date (Mo, Da, Yr)		14 January 1998			
Title: <u>Technical Manual for Navy Shipboard Collective Protection System (CPS): System Description, Operation and Maintenance</u>					
TMCR/TMSR/Specification No.:		TMSR No. NDMS 890230-000A			
CHANGES AND REVISIONS:					
Purpose: <u>Prefilter System Adjustments</u>					
Equipment Alteration Numbers Incorporated:		<u>N/A</u>			
TMDER/ACN Numbers Incorporated:		<u>N/A</u>			
<i>Continue on reverse side or add pages as needed.</i>					
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Dates of issue for original and changed pages are:

Original..0.....01 December 1992

Revision..1.....14 January 1998

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 43, CONSISTING OF THE FOLLOWING:

Page No.	* Change No.	Page No.	* Change No.
Title	1	3-1 to 3-2 blank	0
Certification	1	4-1 to 4-3	1
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CHANGE RECORD

Change No.	Date	Title and/or Brief Description	Signature of Validating Officer
Revision 1	01/14/98	Prefilter Adjustments	

PREFACE

The anticipated use of chemical, biological, and radiological (CBR) weapons against Navy ships has reinforced the need to provide better defensive measures to protect personnel and vital ship spaces from toxic chemical and biological agents and radioactive fallout. The Navy Shipboard Collective Protection System (CPS) provides CBR protection to designated shipboard zones. This manual provides system-level operation and maintenance instructions for CPS.

The system equipment described in this manual was developed and tested by the Naval Surface Warfare Center Dahlgren Division (NSWCDD), and approved by the Naval Sea Systems Command (NAVSEA). Equipment technical manuals are referenced in Chapter 1 of this manual. In certain instances, where prior contractual arrangements did not permit the use of this Navy-designed hardware, actual shipboard equipment may be different. When such deviations exist, the manuals for that equipment should be referred to. Nevertheless, the purpose and function of such equipment should be similar to that described herein.

Ships, training activities, supply points, depots, Naval Shipyards and Supervisors of Shipbuilding are requested to arrange for maximum practical use and evaluation of NAVSEA technical manuals. All errors, omissions, discrepancies, and suggestions for improvements to NAVSEA technical manuals shall be reported to the Naval Sea Data Support Activity (NSDSA), Naval Ship Weapon Systems Engineering Station (NSWSES) (Code 5H00), Port Hueneme, California 93043 on NAVSEA Technical Manual Deficiency/ Evaluation Report, Form NAVSEA 9086/10. To facilitate such reporting, three copies of NAVSEA Form 9086/10 are included at the end of each newly published technical manual. All feedback comments will be thoroughly investigated and originators will be advised of action resulting therefrom. Extra copies of Form NAVSEA 9086/10 may be requisitioned from the Naval Publication and Forms Center (NPFC), Philadelphia, Pennsylvania 19120.

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SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside the equipment with the high voltage supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach into or enter the enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

The following warnings and cautions appear in the text in this volume, and are repeated here for emphasis.

WARNING

If filters become contaminated by CBR agents, a special mobile team will be assigned to change out prefilters and CBR filters. Shipboard personnel shall not change contaminated CBR filters or prefilters. (Page 2-1)

WARNING

Ensure all tag-out procedures are in accordance with current shipboard instructions. (Page 2-1)

WARNING

Always use caution and open only one door at a time while using airlocks or pressure locks. Failure to do so could cause personnel injury (from slamming doors or foreign particles in eyes) and loss of zone pressure. (Page 4-2)

CHAPTER 1 GENERAL INFORMATION

1-1. INTRODUCTION.

1-1.1 Mission. The mission of the Navy Shipboard Collective Protection System (CPS) is to provide filtered air to designated zones to protect against chemical, biological, and radiological (CBR) contamination.

CPS zones can provide either total protection (TP) or limited protection (LP). TP zones protect against all CBR contaminants and are pressurized to allow ship's personnel to carry out normal duties in a CBR environment without individual protection equipment. LP zones do not provide gas protection and are not pressurized. Use of LP zones is limited to machinery spaces; a gas mask must be worn to provide gas protection.

CPS is part of the ship's ventilation supply and exhaust systems. It does not directly involve air conditioning systems used only for recirculation.

1-1.2 Interrelationships of System Equipment.

CPS is a modular system with the number, size, and arrangement of zones varying from ship to ship. Likewise, the number and types of components will vary to satisfy the specific system requirements.

A block diagram showing the interrelationship of CPS components and associated equipment used for TP zones is provided in figure 1-1; for LP zones, in figure 1-2.

1-2 PHYSICAL ARRANGEMENT.

The areas designated as CPS zones are determined during ship design. They almost always coincide with fire zone boundaries. The number and types of protected zones will vary from ship to ship, with the number of TP zones normally ranging from one to five.

1-2.1 TP Zone. Figure 1-3 shows the layout of a typical TP zone, identifying both system components and associated equipment.

The TP supply system consists of the weather air intake/airlift, optional antiblast valve, Navy standard impingement filter (NSIF) roughing filter, preheater, inlet plenum, prefilter(s), CBR filters, outlet plenum, cooling coils, and high-pressure vaneaxial supply fans. Down-

stream of each supply fan is a damper and ductwork distributed through the TP zone. Differential pressure gauges for the CBR filter system and NSIF roughing filter are mounted in or near the fan room.

The TP zone contains pressure control valves (PCVs), airlocks, pressure gauges, and exhaust fans, as needed, depending on the size, physical location, and primary functions of the protected spaces. Each TP zone also contains a zone sensor box, which is part of the CPS alarm system. If compressed air (either high or low pressure) is used inside a TP zone, a CBR filter system will be attached to the compressor intake. Airlocks and pressure locks are provided at TP zone boundaries to allow personnel to enter and exit the TP zone without reducing zone pressure.

The CPS decontamination station is adjacent to, but outside the boundaries of, the TP zone and usually consists of four adjoining spaces: outer clothing undressing area (OCUA), inner clothing undressing area (ICUA), shower area, and contamination purge lock (CPL).

1-2.2 LP Zone. The LP zone contains a weather air intake/airlift with an optional antiblast valve and NSIF roughing filter, optional prefilters, and a commercial off the shelf (COTS) high efficiency particulate arresting (HEPA) filter system located upstream of Navy standard vaneaxial supply fans. Exhaust fans pull air from the LP zone. Figure 1-4 shows the layout of a typical LP system.

1-3 SYSTEM COMPONENTS.

Due to the wide range of equipment available to shipbuilders, many standard shipboard ventilation system components are used in conjunction with CPS, including NSIFs, preheaters, humidistats, cooling coils, dampers, exhaust fans, and fan controllers. Utilize the appropriate component technical manual or the Ship Information Book (SIB) to determine the type of ventilation equipment used, and hence those component's functional descriptions, operating instructions, and Planned Maintenance System (PMS) requirements. CPS components are divided into those used in systems with TP zones and those used with LP zones.

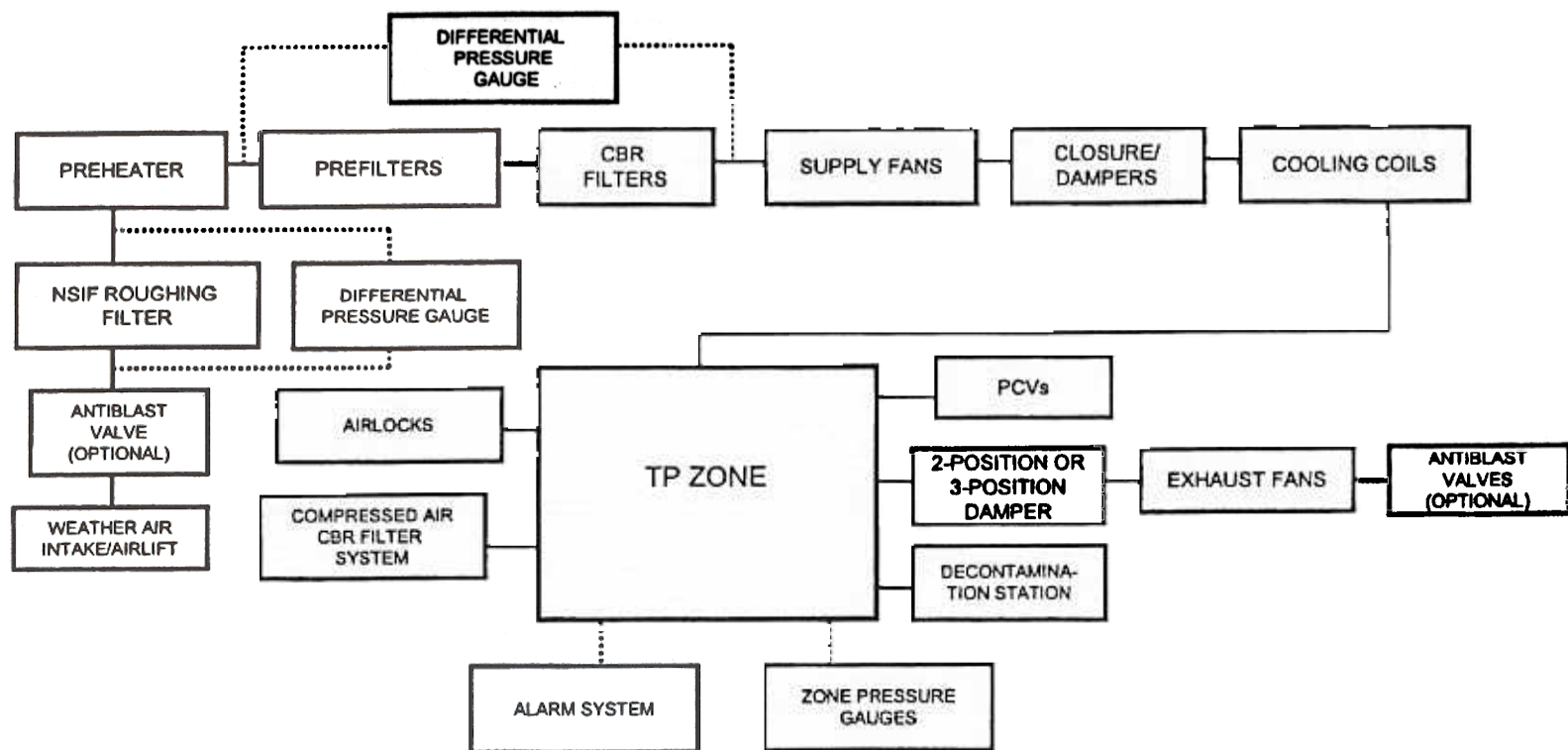


Figure 1-1. Interrelationship of CPS Components and Associated Equipment Used for TP Zone

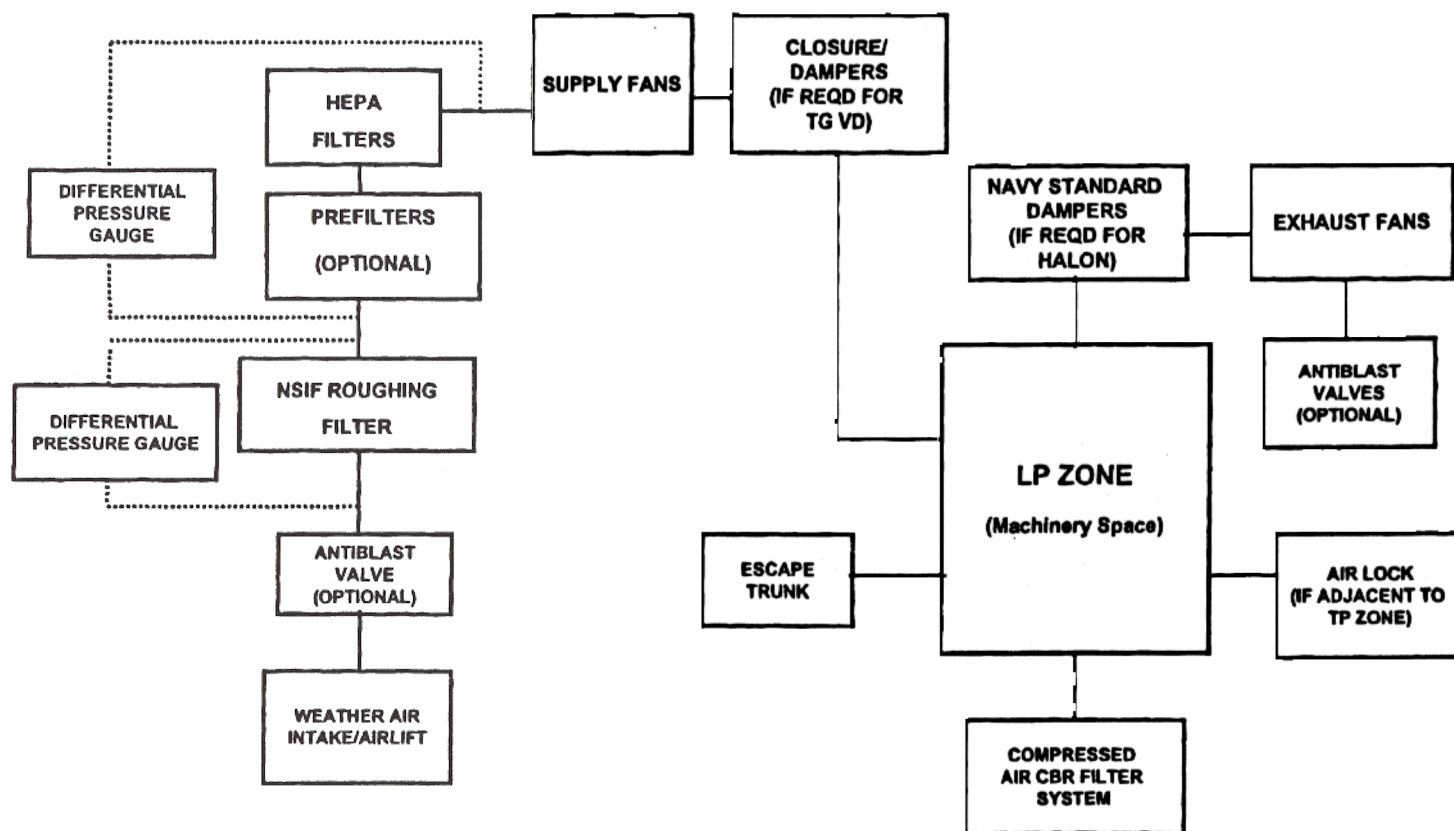


Figure 1-2. Interrelationship of CPS Components and Associated Equipment Used for LP Zone

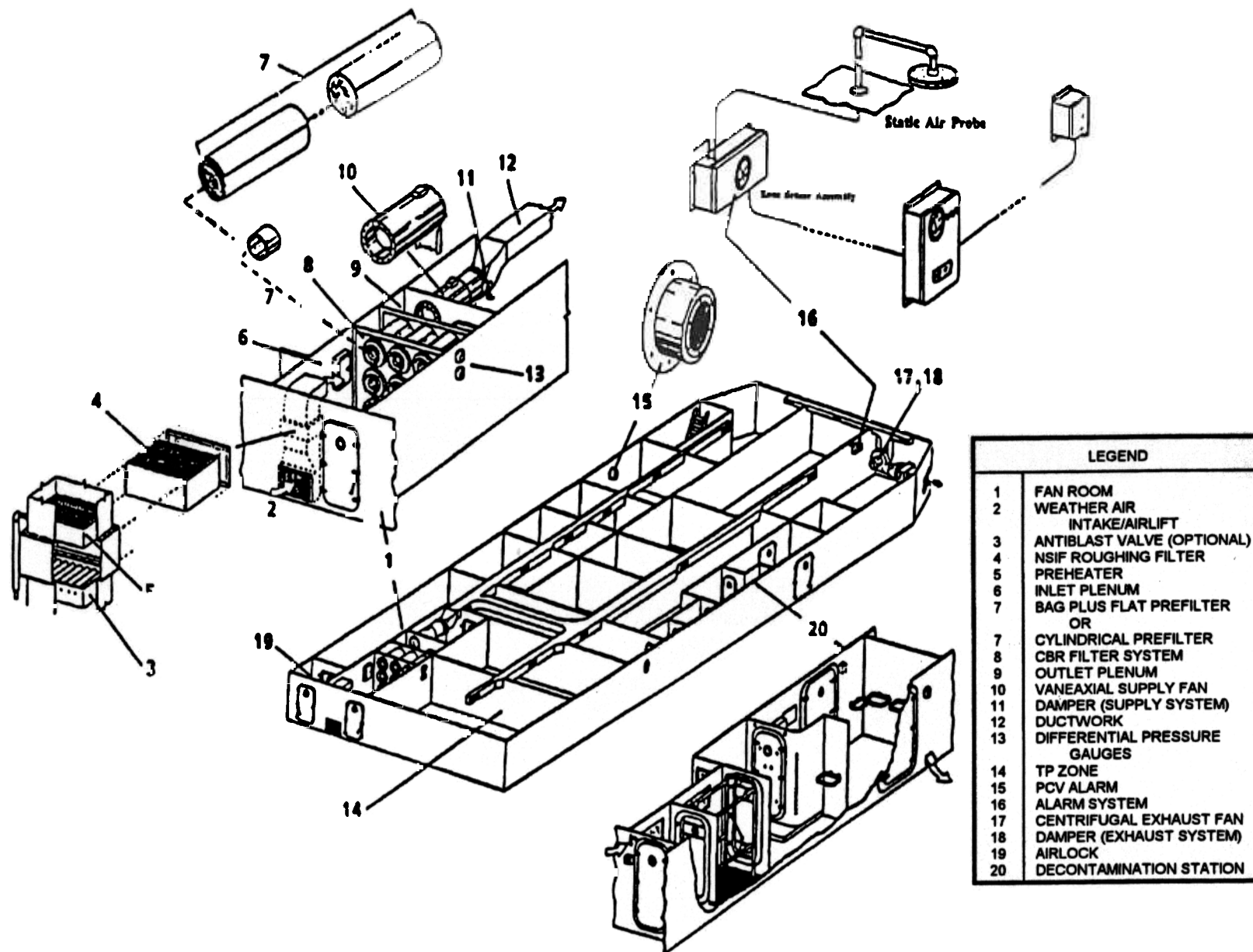


Figure 1-3. Typical Layout of CPS TP Zone (NAVSEA Dwg. No. 6264251)

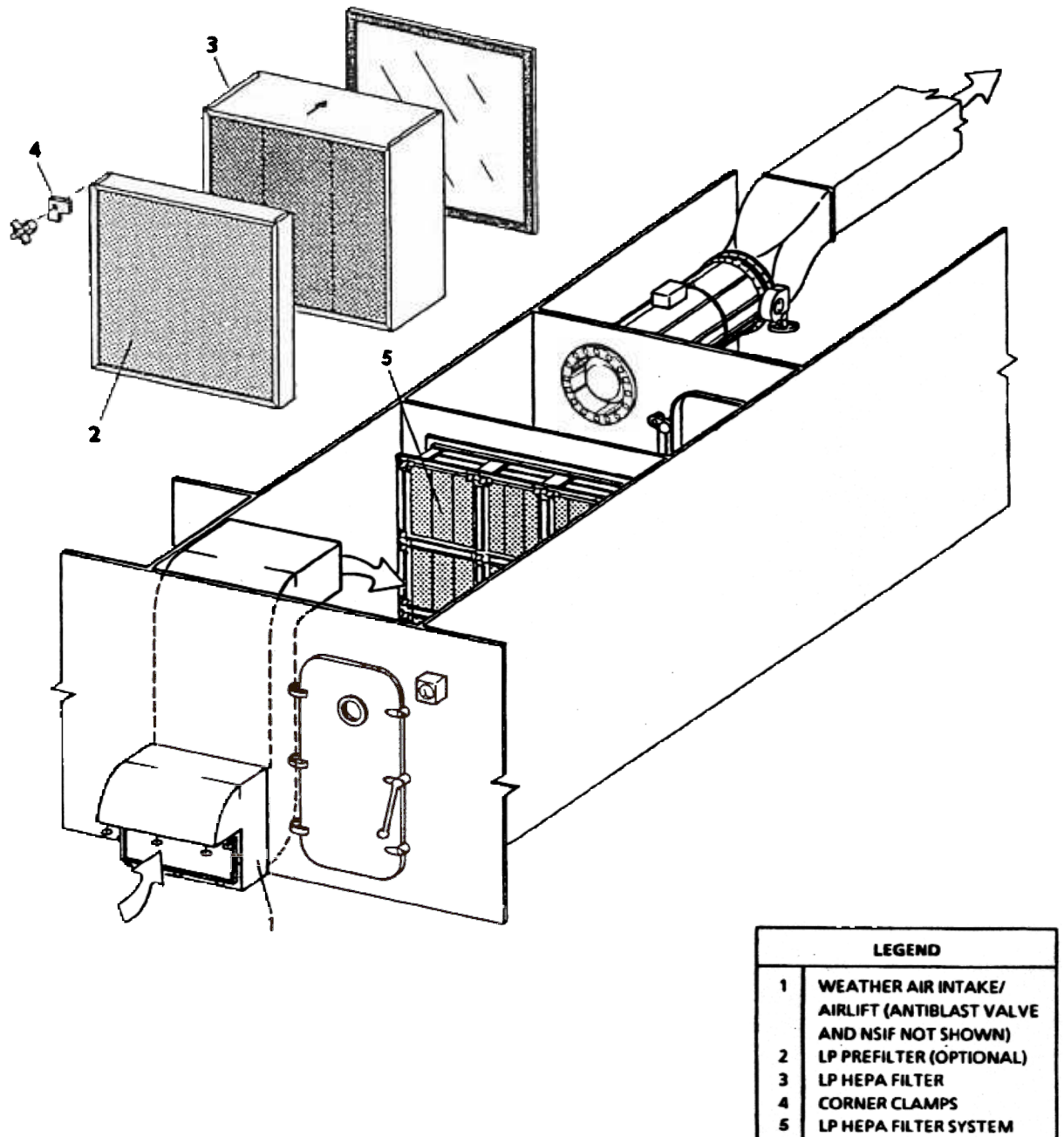


Figure 1-4. Shipboard CPS Components for LP Zone

Components for compressed air filter systems are treated separately, since they serve both TP and LP zones.

1-3.1 TP Zone Components.

1-3.1.1 CBR Filter System. The CBR filter system (figure 1-5) is used in TP zones to remove solid, liquid, and gaseous CBR contaminants from supply air. The system consists of one or more filter housings, each containing prefilters and three CBR filter sets.

The number of housings depends on the supply flow requirements of the TP zone being protected. Each housing has a rated airflow capacity of 600 cfm.

Either one bag plus flat prefilter or three cylindrical prefilters are installed inside the CBR filter sets. The prefilter captures coarse particulates to reduce loading and extend the life of the CBR HEPA filter. Monitoring and maintenance of these prefilters is performed by the ship (O level) and is the most critical CPS maintenance action. Failure to perform prefilter maintenance will result in premature and expensive CBR filter replacement and damage to supply fans.

The CBR filter set, which is packaged and changed out as a unit, consists of a HEPA filter nested inside a gas adsorber. The HEPA filter, which weighs about 10 lb, contains a pleated glass medium for capturing particulates and aerosols. The gas adsorber, which weighs about 35 lb, is filled with activated charcoal to adsorb gases.

CBR filter sets require periodic replacement by an Intermediate Maintenance Activity (IMA). This time period is 3 years. The IMA will also perform a leak test of the installed CBR filters to ensure system integrity. See the CBR Filter System Technical Manual (SS200-AG-MMM-010) for more information.

1-3.1.2 Pressure Control Valve (PCV). Two or more PCVs (15, figure 1-3 [NAVSEA Dwg. No. 6264251]) are used to relieve excess air in TP zones, thus preventing excessive pressure from forcing air through drain traps. They may be mounted either to the bulkhead at the zone boundary or to an accessible duct exhausting to the weather.

1-3.1.3 Alarm System. The CPS alarm system (NAVSEA Dwg. No. 6264216) monitors overpressure in each TP zone. It consists of a master panel, a slave panel, a zone sensor box in each zone, one or more static air probes, and a terminal box (figure 1-6). However, since the number of TP zones differs from

ship to ship, the configuration of alarm system components will vary.

Table 1-1 shows ship classes that this manual applies to and the references to see for other alarm systems.

Table 1-1. Alarm References for Ship Classes

Ship Class	Reference
LSD-44	SS200-AH-MMM-010
LHA-3	SS200-AH-MMM-010
LHA-2&4	SS200-AL-MMM-010
DDG-51	SS200-AH-MMM-010 (pilot house) SIB
LHD-1	SIB
AOE-6	SIB

The master panel (NAVSEA Dwg. No. 6573642), located in Damage Control Central (DCC), is the main alarm panel for monitoring each TP zone. It contains a meter and three indicator lamps per TP zone, up to a maximum of five zones. The master panel also provides an audible alarm when overpressure in any of the monitored TP zones falls below 0.4 in. wg.

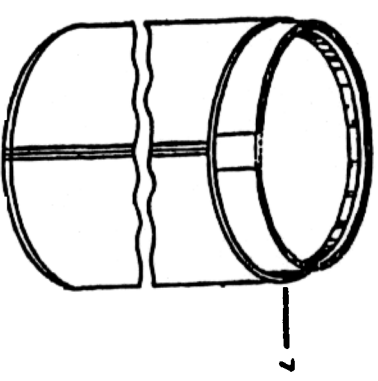
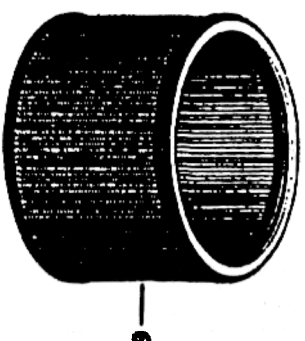
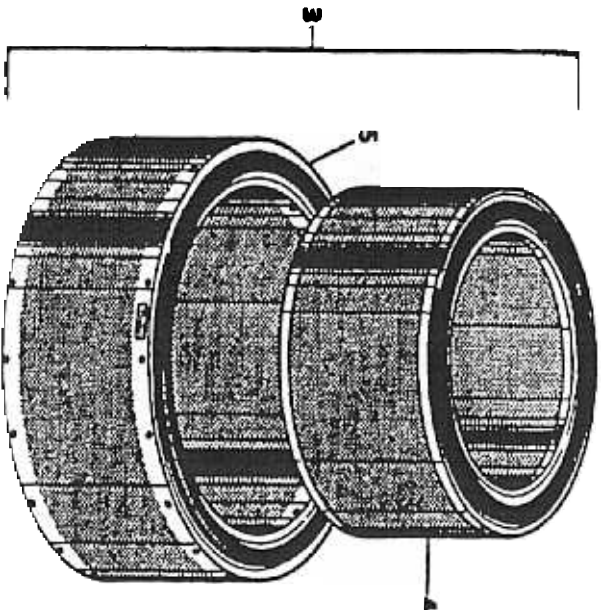
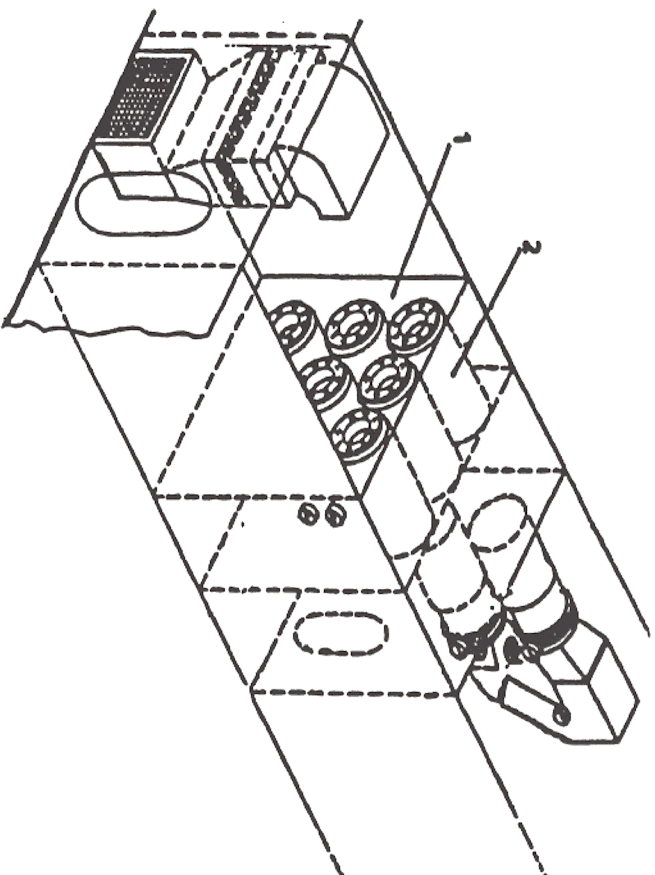
The slave panel (NAVSEA Dwg. No. 6264194), located in the pilot house, has one indicator lamp for each TP zone. Each lamp is controlled by the master panel and lights when overpressure in that zone falls below 0.4 in. wg.

A zone sensor box (NAVSEA Dwg. No. 6264199) is located in each TP zone to measure and monitor the overpressure in that zone. A static air probe is mounted outside the TP zone in an area where it is subjected to ambient air pressure.

The probe (NAVSEA Dwg. No. 6573341), connected through a network of tubing to each zone sensor box, reduces the effects of wind on static pressure and hence provides the true zone pressure.

A terminal box (NAVSEA Dwg. No. 6573369), conveniently located between all units, is used for electrical connection of alarm system components.

1-3.1.4 Airlocks and Pressure Locks. Airlocks and pressure locks (NAVSEA Dwg. No. 6573698) are small, controlled chambers situated at TP zone boundaries, to allow personnel to exit and enter the zone without reducing zone pressure. Each contains two doors that must be opened singly to maintain zone pressure.



LEGEND	
1	CASING
2	HOUSING
3	CBR FILTER SET
4	HEPA FILTER
5	GAS ADSORBER
6	CYLINDRICAL PREFILTER
7	BAG PLUS FLAT PREFILTER OR

Figure 1-5. CBR Filter System

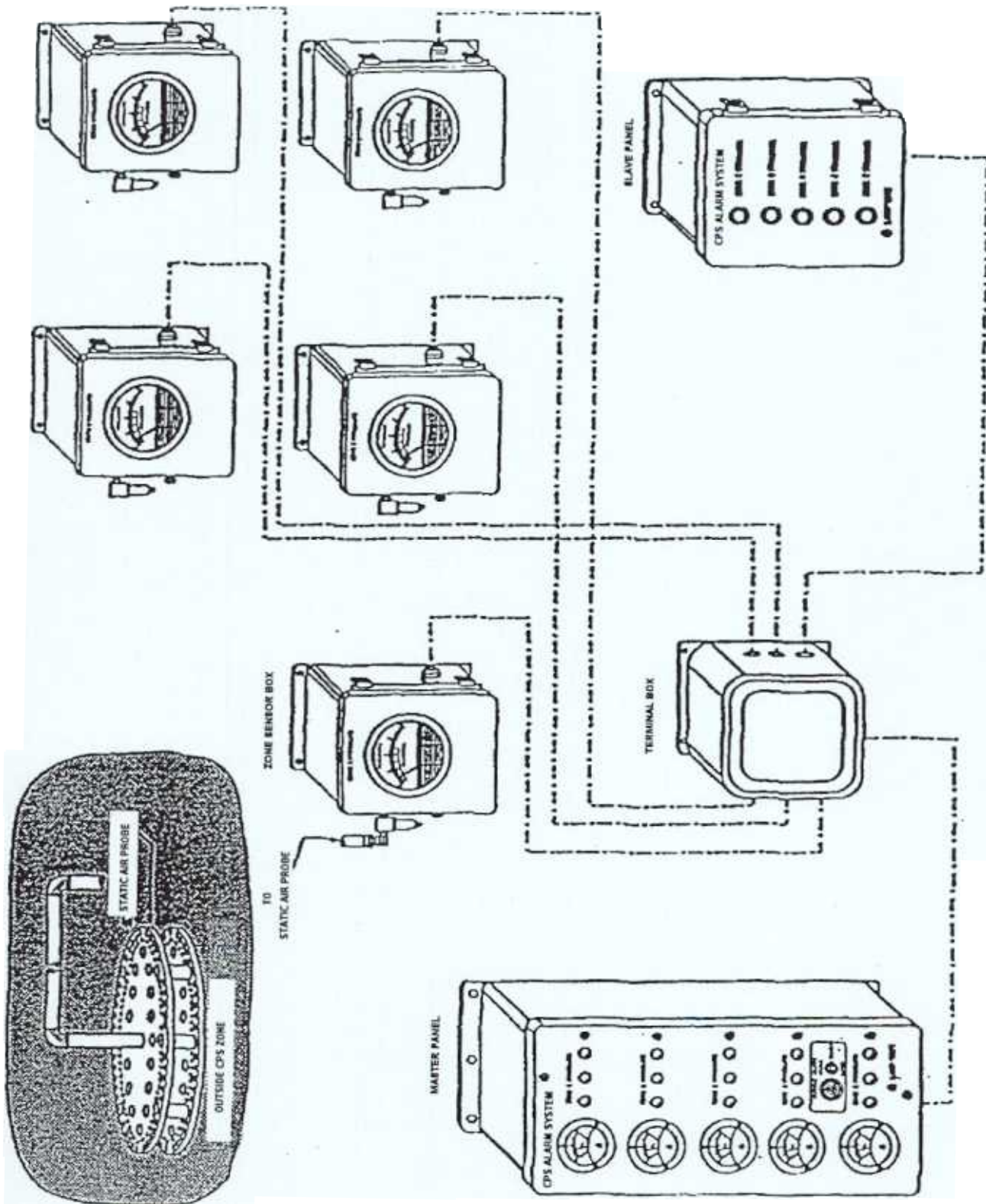


Figure 1-6. Alarm System (NAVSEA Dwg. No. 6264216)

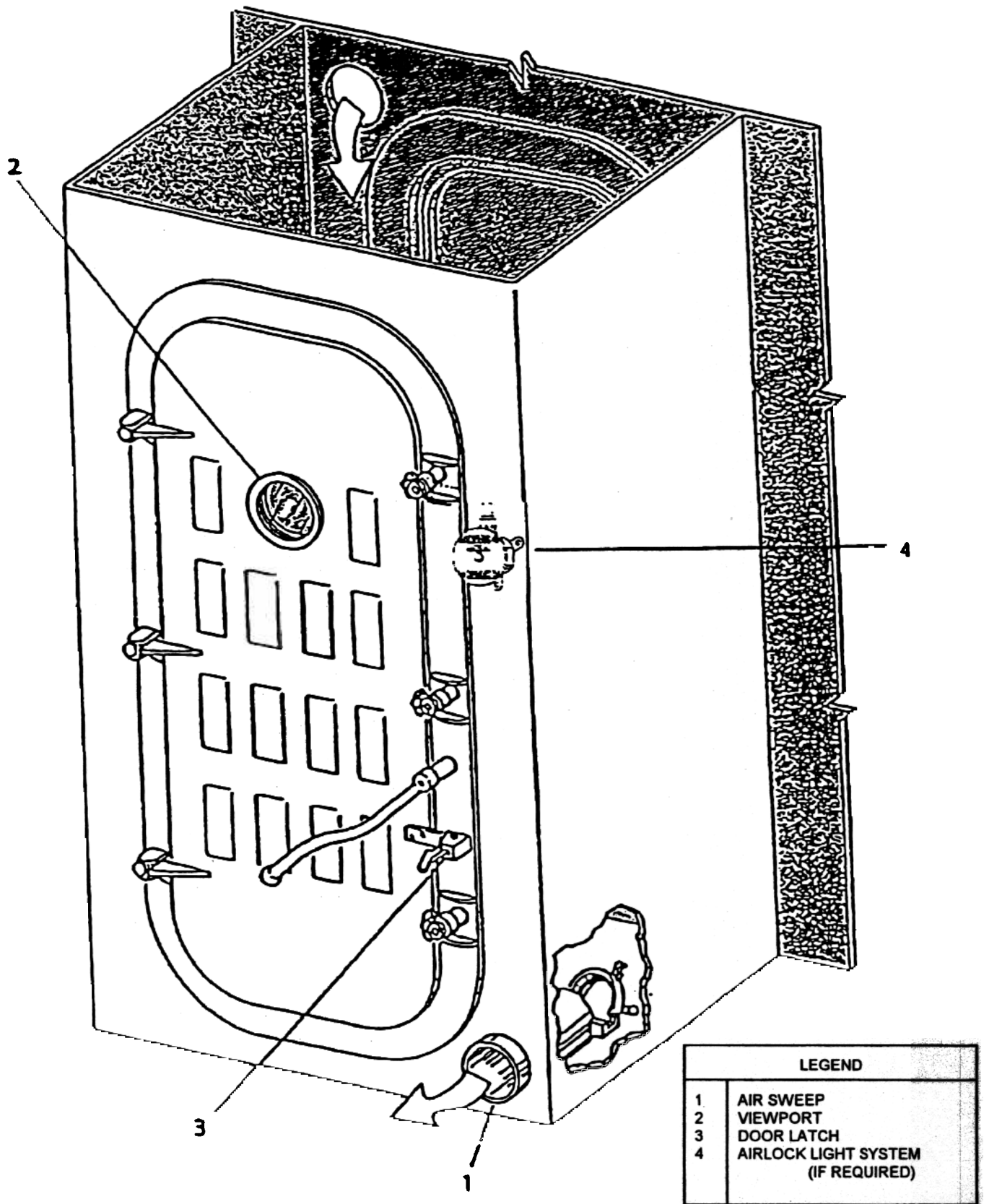
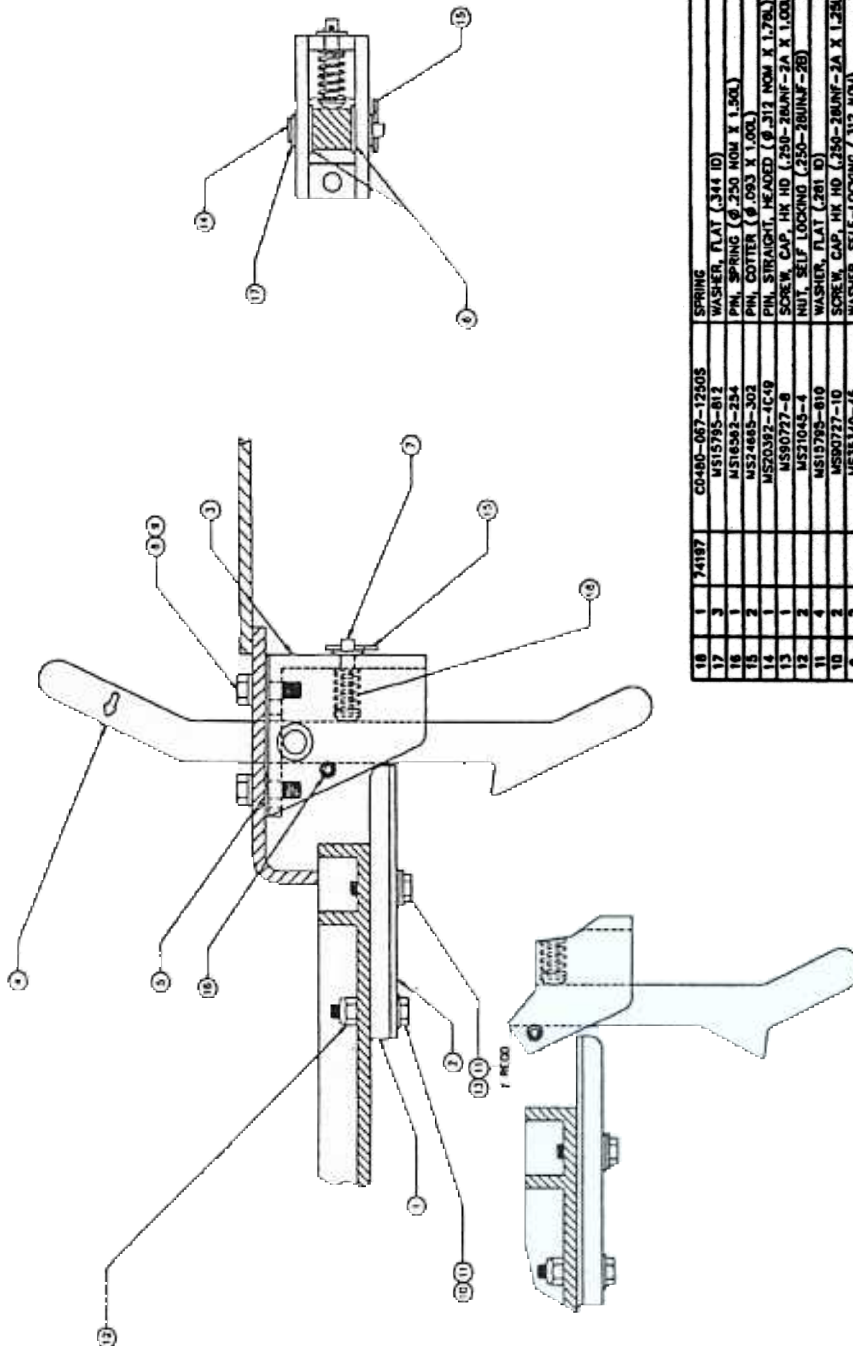


Figure 1-7. Airlock (NAVSEA Dwg. No. 6573698)



NO	QTY	UNIT	PART OR SUBPART NO.	PARTS LIST	MATERIAL
18	1		74187	SPRING	ORES
17	3		C0480-067-12505	WASHER, FLAT (.344 ID)	ORES
16	1		MS15795-812	PIN, SPRING (Ø .250 NOM X 1.50)	ORES
15	2		MS16592-254	PIN, COTTER (Ø .093 X 1.00)	ORES
14	1		MS24665-302	PIN, STRAIGHT HEADED (Ø .312 NOM X 1.78)	STEEL
13	1		MS20392-1C49	SCREW, CAP, HK HD (.250-28UNF-2A X 1.00)	ORES
12	2		MS20727-8	NUT, SELF LOCKING (.250-28UNF-2B)	ORES
11	4		MS21045-4	WASHER, FLAT (.281 ID)	ORES
10	2		MS15795-810	SCREW, CAP, HK HD (.250-28UNF-2A X 1.25)	ORES
9	2		MS90727-10	WASHER, SELF-LOCKING (.312 NOM)	ORES
8	2		MS33340-15	SCREW, CAP, HK HD (.312-24UNF-2A X 1.00)	ORES
7	2		MS90727-34	PIN, SPRING HOLDING	ORES
6	2		8573633	WASHER	ORES
5	2		8573632	GASKET, LEAK SEALING	ORES
4	1		8573630	HANDLE (Ø TYPES)	ORES
3	1		8573629	BRACKET ASSEMBLY	ORES
2	1		8573628-2	PLATE, STRIKE	ORES
1	1		8573628-1	PLATE, STRIKE	ORES
PART OR SUBPART NO.				DESCRIPTION OR REMARKS	MATERIAL

Figure -8. Diagram and Parts List for Door Safety Latch (NAVSEA Dwg. 0573626)

Airlocks (figure 1-7) have air sweeps to purge any airborne contaminants, and either a fixed light or viewport in each door for determining when the airlock is in use. Pressure locks do not have air sweeps. After a CBR attack, pressure locks must not be used, and a standard airlock must be allowed to purge for approximately 2 min before it can be used again. There are three types of air locks. Type 1 provides access between a pressurized CPS zone and the weather. Type 2, access between a pressurized CPS zone and an unpressurized zone or space. Type 3, access between CPS pressurized zones.

Both airlock and pressure lock doors, as well as all doors at the zone boundaries, are outfitted with a door safety latch (NAVSEA Dwg. No. 6578626). The latch acts as a safety catch to prevent an improperly opened boundary door from flying open when the zone is pressurized. A mounted safety latch is shown in figure 1-7. A diagram of the safety latch is shown in figure 1-8. On airlocks where the opposite or adjacent door(s) cannot be seen from each other, the airlock light system (ALS) (NAVSEA Dwg. No. 7244085) is installed. The red light(s) illuminate when an airlock door is opened, to alert personnel that the airlock is being used, and not to enter. The mounted ALS is shown in figure 1-7.

1-3.1.5 Decontamination Station. The decontamination station (NAVSEA Dwg. No. 8045959203) is adjacent to the TP zone and must be used to enter the zone from contaminated areas after a CBR attack. Although the size and configuration of the station may vary from ship to ship (figure 1-9), the most common, fully equipped decontamination station has four chambers through which personnel must pass during the decontamination process: the OCUA, ICUA, shower, and CPL.

1-3.2 LP Zone Components.

1-3.2.1 LP HEPA Filter System. The HEPA filter system (figure 1-4) is used in LP zones to remove solid and aerosol CBR contaminants from supply air. The system consists of one or more HEPA filters mounted in a frame. The number of filters and size of the mounting frame depends upon the supply flow requirements of the LP zone. Each HEPA filter has a rated flow capacity of 2,000 cfm maximum.

Each LP HEPA filter system requires periodic leak testing to ensure system integrity. This leak testing must be performed after every major ship overhaul by IMAs. Ships must submit a work request to the IMA after the ship's overhaul period.

1-3.2.2 LP Prefilter. LP prefilters (2, figure 1-4) may be installed immediately upstream of each HEPA filter to reduce the dust loading on the HEPAs, greatly extending the HEPA life. When used, the prefilters are mounted in the HEPA filter system frame using existing corner clamps (4, figure 1-4). Each prefilter has a rated flow capacity of 2,000 cfm.

1-3.3 Compressed Air CBR Filter Systems. Compressed air (LPAC/HPAC) supplied to TP and LP zones is filtered of solid, liquid, and gaseous CBR contaminants. One of two types of filter systems can be used. One system is identical to a single CBR filter system housing used in TP zones (A, figure 1-10). This filter system has a rated flow capacity of 600 cfm and houses three 200-cfm CBR filter sets. Air is ducted from the back of the filter housing to the compressor intake. The other system (B, figure 1-10) uses a single 100-cfm CBR filter set (M-48) NSN 4240-01-161-3710 containing both a HEPA element and a gas adsorber mounted in a housing, along with a small NSIF upstream for coarse particulate removal. Air is ducted from a fitting on top of the CBR filter to the compressor intake.

The CBR filters in compressed air systems require periodic replacement by an IMA. This time period is 3 yr. The IMA will also perform a leak test of the installed CBR filters to ensure system integrity.

Due to the design of the compressed air supply system, the low volume of air supplied, and the periodic operation of this system, periodic maintenance by O-level personnel is not required. In addition, the use of prefilters is not required for these compressed air systems.

1-4 ASSOCIATED SYSTEM EQUIPMENT.

1-4.1 Antiblast Valve. An optional antiblast valve (3, figure 1-3) is usually located at each intake and exhaust port of both TP zones and LP zones, to protect CBR filters and other components from damage caused by overpressure resulting from nuclear and conventional air blast.

1-4.2 NSIF Roughing Filter. Both TP and LP zones may use NSIF roughing filters (4, figure 1-3), installed in the weather air intake/airlift immediately downstream of the antiblast valve. The NSIF uses a metal mesh medium to prevent large particles from entering the inlet plenum.

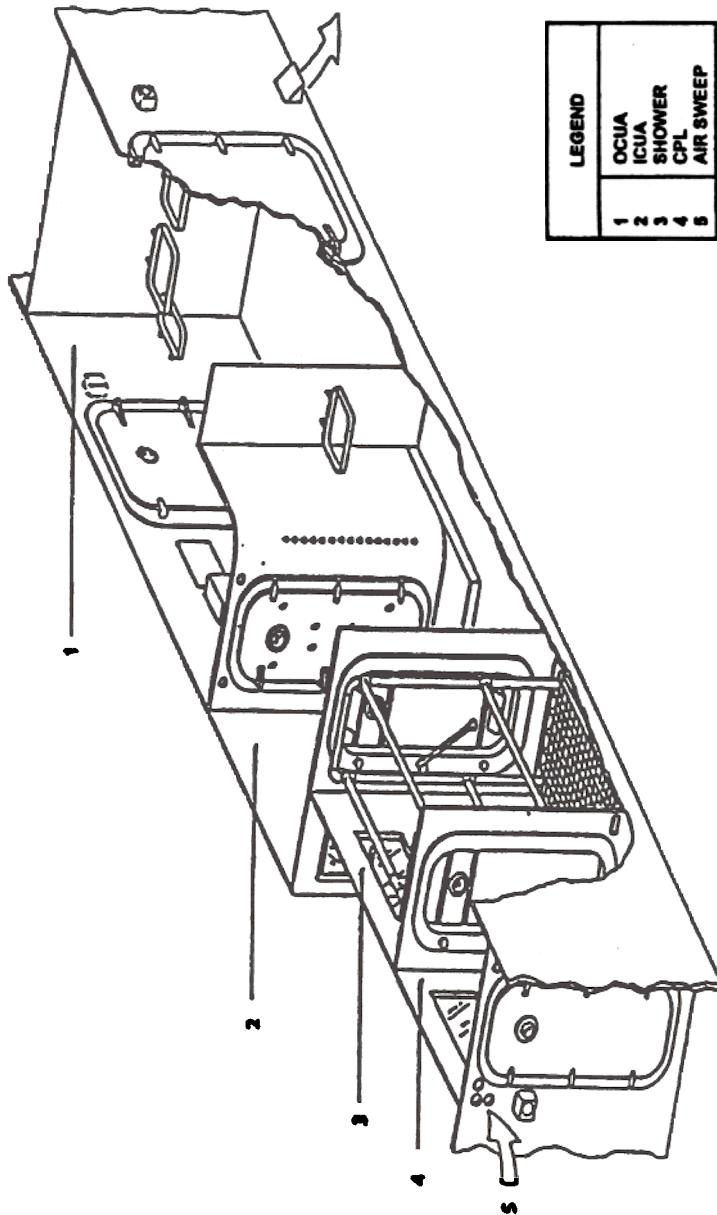
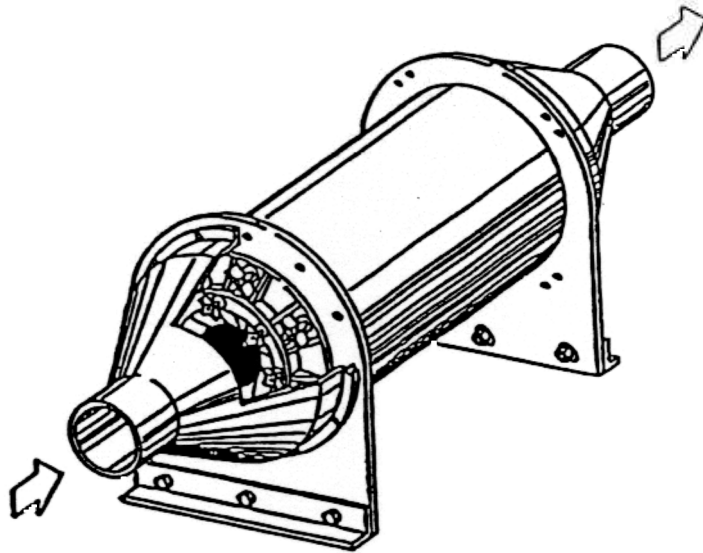
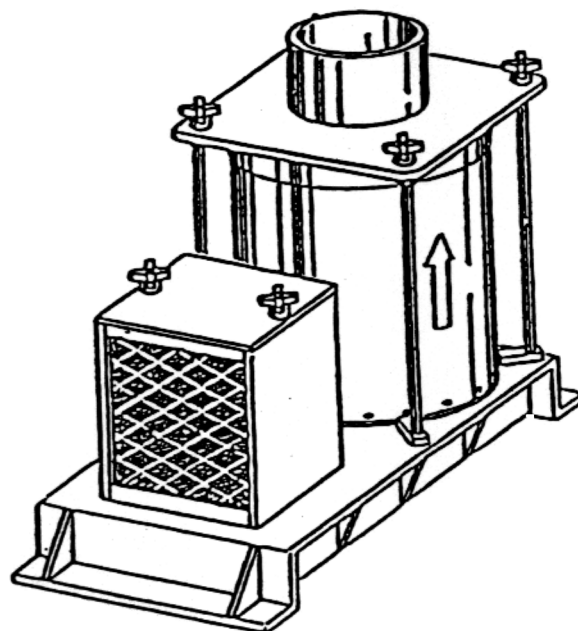


Figure I-9. Decontamination Station (NAVSEA Dwg. No. 8045959203)



cfm



100 cfm

Figure Typical 100 cfm Filter System

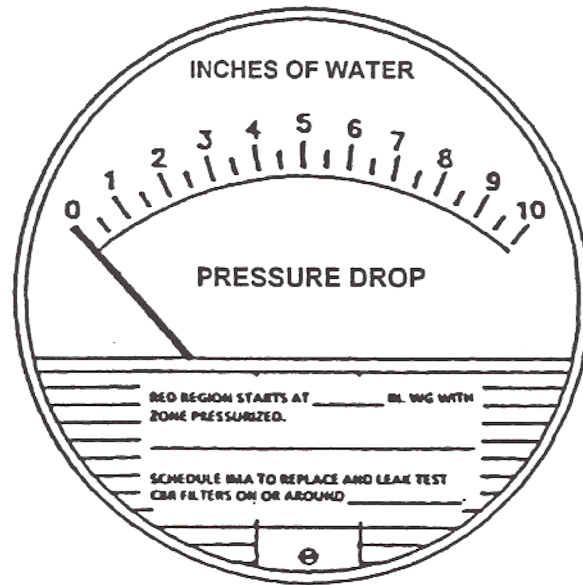


Figure 1-11. Typical CBR Filter System Differential Pressure Gauge Face (NAVSEA Dwg. No. 6573294-3)

1-4.3 Preheater. A preheater (5, figure 1-3), installed in the weather air intake/airlift, downstream of the NSIF, is used to precondition intake air before it enters the CBR filter system for a TP zone. The preheater is controlled by a thermostat and a humidistat to regulate temperature and humidity

1-4.4 Supply Fan. Vaneaxial supply fans (10, figure 1-3) are located downstream of the CPS filter systems. The fans pull air through the filter system and supply it to the zone through ventilation ducts. Supply fans provide ventilation and replenishment air and generate the positive pressure necessary for TP zones.

1-4.5 Differential Pressure Gauge. Differential pressure gauges are mounted near the NSIF roughing filter, CBR filter system, compressed air filter system, and LP HEPA filter system. These gauges measure pressure drop across the respective filters, providing an indication of airflow resistance. A sample gauge face is shown in figure 1-11. Each CBR filter system gauge face includes a sticker applied during the last CBR filter change by an IMA. This sticker specifies a red region to indicate high-pressure drop, as well as the date of the next scheduled CBR filter change. Each NSIF gauge face shows a red mark to indicate high-pressure drops. Each LP HEPA gauge also has markings to indicate high-pressure drops. The span of each region will vary from gauge to gauge, depending on ventilation system design and fan capacity. See Technical Manual SS200-AG-MMM-010 for additional information.

All CBR filter, LP HEPA, and alarm system gauges are considered critical for calibration purposes. The recommended calibration interval is every 2 yr. (See section 6-2.1)

1-4.6 Zone Pressure Gauges. Throughout each TP zone and near airlocks, pressure gauges are installed to provide local indication of zone pressure. These gauges are for reference only, and should not be used as an indicator of true zone pressure. Due to changes in wind conditions and location of the gauge's reference probe, these gauges may read differences up to 1.0 in. wg in the same zone. Only the alarm system sensor box and DCC gauges show true zone pressure. Zone pressure gauges are not critical and do not require calibration. The zone pressure gauge face (figure 1-12) is divided into red, yellow, and green regions corresponding to the CPS alarm system. The green region, 1.5–2.5 in. wg, denotes normal zone pressure levels. The yellow region, 0.4–1.5 in. wg, denotes that zone pressure is lower than normal. The red region, 0–0.4 in. wg, denotes that zone pressure has fallen below minimum functional status (MFS).

1-4.7 Exhaust Fan. One or more exhaust fans (17, figure 1-3) are used to remove air from TP zones. The exhaust fans are located inside the protected zone and are connected to exhaust openings via ductwork.

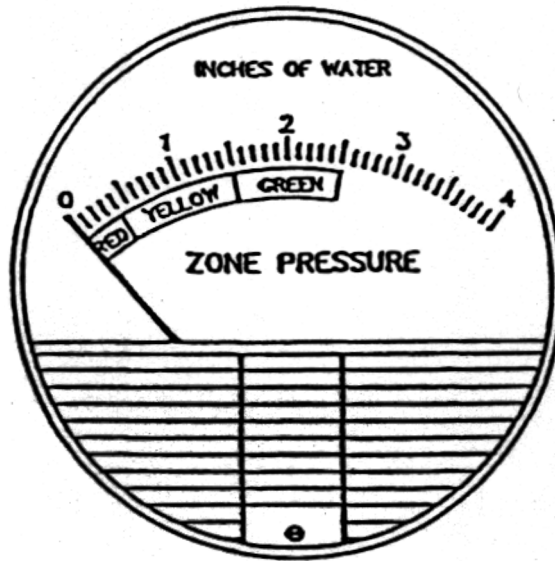


Figure 1-12. Zone Pressure Gauge Face
(NAVSEA Dwg. No. 6573294-1)

1-4.8 Drain Traps. Each water drain trap located in CPS zones is a 5-in. trap (versus the usual 2-in. trap). These 5-in. traps are necessary to prevent the pressurized zone overpressure from emptying the trap or causing sewer gases to escape when the CPS zone is not pressurized.

1-4.9 Preheaters/Humidistats. CPS uses standard Navy preheaters and humidistats. The standard Navy preheater may be either the steam or electric type. The preheater is activated by a thermostat when the intake air is less than 42 °F or by a humidistat when intake air has greater than 70% relative humidity. Due to the wide range of equipment available, the SIB should be consulted to determine the type of preheater or humidistat, as well as specific information concerning operation and maintenance.

1-5 REFERENCE DATA.

CPS equipment capabilities are described in table 1-2. CPS publications are listed in table 1-3. Additional information related to the operation and maintenance of CPS may be found in the SIB, the Damage Control (DC) book and plates, along with the booklet of general plans, NWP 62-1 and NSTM Chapters 470, 070, 079, and 510. Special tools and test equipment used with CPS are limited to unique items used to maintain specific system equipment and are described in detail in the applicable equipment manuals.

Table 1-2. CPS Equipment Capabilities

Equipment	Zone Type	Capability
CBR Filter System Bag plus Flat Prefilter Cylindrical Prefilter CBR Filter Set	TP	600 cfm per filter housing 600 cfm each (1- per housing) 200 cfm each (3 - per housing) 200 cfm per filter set (3 - per housing)
LP HEPA Filter System LP Prefilter (Optional) LP HEPA Filter	LP	1000-2000 cfm 1000-2000 cfm
PCV	TP	Begins to open at 2.0 in. wg; exhausts 700-900 cfm at 2.5 in. wg
Alarm System	TP	Monitors zone pressure (in as many as five zones) between 0-4 in. wg

Table 1-3. Reference Publications

Publication Number	Title
SS200-AG-MMM-010	Navy Shipboard Collective Protection System (CPS) Technical Manual: Chemical, Biological, and Radiological (CBR) Filter System Operation and Maintenance
SS200-AH-MMM-010	Navy Shipboard Collective Protection System (CPS) Technical Manual: Alarm System Operation and Maintenance
SS200-AJ-MMM-010	Navy Shipboard Collective Protection System (CPS) Technical Manual: Pressure Control Valve (PCV) Operation and Maintenance
SS200-AK-MMM-010	Navy Shipboard Collective Protection System (CPS) Technical Manual: Decontamination Station Operation and Maintenance (DRAFT)

CHAPTER 2 SYSTEM SAFETY PRECAUTIONS

2-1 INTRODUCTION.

This chapter summarizes the hazards to personnel and equipment associated with the operation and maintenance of the Navy Shipboard Collective Protection System (CPS). The primary mission of CPS is to protect personnel from chemical, biological, and radiological (CBR) contamination. Personnel should make every effort to ensure the system is properly operated and maintained to enhance personnel safety.

2-2 SYSTEM HAZARDS AND PRECAUTIONS.

2-2.1 Operational Safety Summary. The precautions below should be taken when operating CPS. Failure to do so could cause personnel injury or equipment failure that may affect personnel safety.

- a. Always use caution and open only one door at a time while using airlocks or pressure locks. Failure to do so could cause personnel injury (from slamming doors or foreign particles in eyes) and loss of zone pressure.
- b. In a CBR environment, the only way to enter the CPS zone from the weather is through a CPS decontamination station.
- c. Do not use the decontamination station shower for training if the water temperature is below 50 °F.
- d. In a CBR environment, personnel may exit the CPS zone only via an airlock while wearing at least a protective mask. A standard airlock must be allowed to purge for approximately 2 min before it can be used again.
- e. Since CPS supply fans provide fresh (replenishment) air to the zone, these fans should not be secured, except for maintenance or emergencies only.
- f. Do not open the outlet plenum hatches while the CPS fan is running. Personnel injury and fan damage may result.

- g. Failure to perform maintenance on the CPS prefilters will cause the fan to stall, causing damage to fan bearings and other components.
- h. Shipboard personnel should never attempt to remove or replace CBR contaminated filters or prefilters. This job should be left to a specially trained mobile team.
- i. All drain traps in the CPS zone must be filled with water to prevent sewer gases from infiltrating the CPS zone when the CPS zone is not pressurized.
- j. In a CBR environment, personnel in CPS zones must carry their masks in the quick-don position in the event that the CPS zone pressure is compromised through battle damage or other means.
- k. Ship personnel should never remove CBR filter set covers/knobs unless they are prepared to have those filters leak-tested again by an Intermediate Maintenance Activity (IMA).

2-2.2 Maintenance Safety Summary. The precautions below should be taken during CPS maintenance. Failure to do so could cause personnel injury or equipment failure that may affect personnel safety.

WARNING

If filters become contaminated by CBR agents, a special mobile team will be assigned to change out prefilters and CBR filters. Shipboard personnel shall not change contaminated CBR filters or prefilters.

WARNING

Ensure all tag-out procedures are in accordance with current shipboard instructions.

CHAPTER 3

CONDITIONS OF READINESS

3-1 INTRODUCTION.

The effectiveness of any chemical, biological, and radiological (CBR) countermeasure depends on prompt initiation of protective action.

The design intention of the Navy Shipboard Collective Protection System (CPS) is for total protection (TP) zones to be pressurized, regardless of the level of CBR attack. Because ventilation supply air serving TP zones is filtered of CBR contaminants at all times, CPS provides full-time protection as long as the zone is pressurized.

Ventilation airflows and heating and cooling loads are designed and balanced for a pressurized zone. Most doors, hatches, and similar boundary penetrations will normally be closed during routine steaming and nonthreat conditions, to maintain desired temperature, humidity, and pressure levels.

Some situations may require doors, hatches, and other zone boundary fittings to be open, thereby preventing the

zone from pressurizing. No harm to equipment or personnel will result from operating without the zone pressurized, but it should be understood that there is no CBR protection. Also, normal airflow throughout the zone may be altered, resulting in wind-tunnel effects as air rushes to escape through the opening. Conditioned air for heating and cooling may also be diverted from its normal flow patterns during this period, as well as degradation of the ship's exhaust systems for ships without 3-position dampers in exhaust fans/system design. With a properly operating system, zone pressure can be restored to a steady-state value within approximately 2 min after closing all zone boundary doors, hatches, and other penetrations.

CPS readiness is ensured when the system is fully operating, maintenance is up to date, and zone pressure is 2.0 ± 0.5 in. wg. TP zones should be pressurized before an attack to prevent infiltration of CBR contaminants through zone boundary leaks.

Specific readiness conditions to be observed when CPS is not fully pressurized (less than 1.5 in. wg) are combined with the operating procedures of Chapter 4.

CHAPTER 4 OPERATION

INTRODUCTION.

This chapter describes Navy Shipboard Collective Protection System (CPS) operating situations and procedures. It identifies preoperational conditions presumed to be in effect, and describes normal and emergency operation.

4-2 PREOPERATIONAL CONDITIONS AND SETUP.

Before operating CPS, the following conditions are presumed to be in effect for both limited protection (LP) and total protection (TP) zones:

- a. Prefilters and filters are installed and any housing covers, fasteners, and related hardware are in place.
- b. Supply and exhaust fans are running, with all dampers open.

The following additional preoperational conditions are presumed to be in effect for TP zones:

- a. Inlet and outlet plenums are free from debris and foreign material that could restrict airflow.
- b. All plenum doors and hatches are closed and dogged.
- c. All drain traps in the zone are full of water. (If supply and exhaust fans were not started simultaneously, water in the drain traps may have been displaced).

NORMAL OPERATION.

CPS is designed to be a continuously operating system; that is, fans, filters, gauges, and meters are always functioning and ventilation supply and compressed air are always filtered. LP zones require no further action to maintain normal operation. Additional actions required for normal operation of TP zones are described below.

4-3.1 Initiating Total Protection.

- a. Close all airlock, pressure lock, and decontamination station doors, and ensure all air sweep fittings are open (except on specially identified airlocks).

NOTE

Both the inner and outer doors of airlocks, pressure locks, and decontamination stations must be closed for normal operation of CPS. Zone pressure can be achieved if only one door of an airlock, pressure lock, or decontamination station is closed. This, however, does not provide normal operation of the zone, and entry/exit of the zone cannot be accomplished without losing zone pressure and posing a personnel safety hazard.

- b. Close all remaining doors, hatches, and other openings at zone boundaries.
- c. Check zone pressure in each TP zone by observing alarm system gauges on either zone sensor box or alarm panel in Damage Control Central (DCC). Pressure should rise to 2.0 ± 0.5 in. wg and stabilize in approximately 2 min. If zone pressure does not reach 1.5 in. wg, follow the troubleshooting procedures in Chapter 7.
- d. Check audible alarm control switch on alarm system master panel in DCC. Switch should be in the center (ENABLE) position for normal operation. Audible alarm will sound when the master panel is initially turned on (Circuit Breaker pushed in). Reset audible alarm by depressing control switch toggle to SILENCE position and release immediately.

NOTE

The audible alarm will sound when the control switch is depressed and held in the SILENCE position. It will turn off when the switch is released and returned to the ENABLE position.

4-3.2 Operating a Fully Pressurized TP Zone.

Once a TP zone is pressurized, all personnel must use airlocks or pressure locks to enter and exit TP zones during non-threat conditions.

WARNING

Always use caution and open only one door at a time while using airlocks or pressure locks. Failure to do so could cause personnel injury (from slamming doors or foreign particles in eyes) and loss of zone pressure.

DCC personnel monitor the pressure level in each TP zone from the CPS alarm system master panel. All meters on the master panel should be in the green region with corresponding green indicator lamps lit. The Officer of the Deck should be notified immediately if a TP zone loses pressure.

The slave panel in the pilot house warns when pressure in any zone falls below 0.4 in. wg. All red lamps on the slave panel in the pilot house should be unlit. The Officer of the Deck may monitor the slave panel and consult with DCC regarding pressure levels.

Normal entry/exit through airlocks can cause momentary fluctuations in zone pressure. Drops in pressure due to traffic can be discerned from unintended zone boundary violations by carefully monitoring the response of zone pressure gauges.

4-3.2.1 Entering a TP Zone During Threat Conditions. If liquid, solid or aerosol contaminants are present, personnel must enter TP zones only through CPS decontamination stations.

In a CBR environment, the only way to enter a TP zone from the weather is through a CPS decontamination station.

If only chemical agent vapors are present, personnel may enter the TP zone via an airlock, but only after waiting for a period of 2 min inside a standard airlock. This 2-min time period allows any hazardous vapors to purge.

4-3.2.2 Exiting a TP Zone During Threat Conditions. In a CBR environment, personnel may exit the TP zone only via an airlock while wearing at least a protective mask. A standard airlock must be allowed to purge for approximately 2 min before it can be used again.

4-3.3 Operating an Unpressurized TP Zone.

Under certain circumstances it may be necessary to operate a TP zone without pressurization. In this situation the ventilation, heating, and cooling may not be fully satisfactory, since TP zones are designed to have a 2.0 in. wg pressure.

Opening any door between the zone and weather deck or an area of atmospheric pressure will allow the air in the zone to escape uncontrolled, and pressure will fall to zero. Zone pressure and alarm gauges for the affected zone will indicate low/no pressure (red region), and the corresponding red lamps on the master panel and the slave panel will be lit.

4-4 EMERGENCY OPERATION.

As long as zone boundaries are not violated, pressure can be maintained at normal levels (1.5 to 2.5 in. wg) for extended periods of time. Casualty operation occurs when zone pressure falls below 0.4 in. wg at which point corrective action must be taken.

After a chemical, biological and radiological (CBR) attack, emergency operation is required when TP zone pressure drops below minimum functional status (MFS) of 0.4 in. wg due to battle damage or loss of a supply fan(s). These situations differ from a gradual decay in zone pressure over a period of months due to emerging leaks at the zone boundary (i.e., worn door gaskets).

One way to sustain zone pressure during emergency conditions is to open the ailing zone to an adjacent, fully functional TP zone. This concept is known as zone boosting.

As last resorts to maintain zone pressure, exhaust airflow can be temporarily restricted and airlock and decontamination station fittings closed to minimize air loss. Ship's personnel must be cognizant of these actions so that the zone is not contaminated by personnel ingress/egress.

4-4.1 Battle Damage. The amount of damage a zone boundary can suffer varies with the size and filtration capacity of the zone. Large holes in the zone boundary require closing off surrounding doors to isolate the damage. Repair parties tending to the damage during CBR threat conditions should be suited according to the applicable readiness level set forth in the CBR defense bill. The repaired area should never be reconnected in

the zone unless appropriate monitoring equipment determines that no contamination exists.

4-4.2 Supply Fan Failure. In zones served by multiple supply fans, loss of a single fan may not be catastrophic if pressure can be sustained by the remaining fans. If pressure falls below 0.4 in. wg, corrective action must be taken.

4-4.3 Zone Boosting. For a multi-zone CPS ship, an ailing TP zone can sometimes be supported by an adjacent, fully functional TP zone by opening interconnecting doors. The adjacent zone must be at

least as large as the ailing zone, with approximately the same filtration capacity. Zone boosting should be used only when combined zone pressure can be maintained above 0.4 in. wg. If pressure in any zone is completely lost (0 in. wg), due to large holes in the zone boundary, opening an adjacent zone will most likely cause zone pressure loss in that zone also. The decision to interconnect zones should only be made with an understanding of the risks, in consultation with repair parties and their assessment of damage. Any zone contaminated during a period of no pressure should not be connected to a fully functional zone.

CHAPTER 5

FUNCTIONAL DESCRIPTION

5-1 INTRODUCTION.

This chapter provides an overall, summary description of the Navy Shipboard Collective Protection System (CPS) operation, as well as a detailed description based on the function of individual system components.

5-2 OVERALL FUNCTIONAL DESCRIPTION.

Figure 5-1 shows the basic functional flow of CPS. Air enters CPS and passes through one or more prefilters, where coarse particles are removed. The air then passes through the chemical, biological, and radiological (CBR) filter system, where contaminants are removed. The filtered air is then directed to the protected zone under slight overpressure, and then exhausted back to the weather.

5-3 DETAILED FUNCTIONAL DESCRIPTION.

CPS zones can provide either total protection (TP) or limited protection (LP). Both types operate full time. Although CPS can consist of a combination of both zone types, TP and LP zones operate independently of each other. Detailed functional descriptions of both types of zones are provided below.

5-3.1 TP Zones. Figure 5-2 shows the functional flow of a TP system. The TP system uses the CBR filter system to remove particulate, aerosol, and gas contaminants from intake air. TP zones provide personnel protection without the need for any individual protective equipment.

High-pressure vaneaxial fans pull air through the filters and pressurize the zone. Air enters the supply system through a weather intake and passes through an optional antiblast valve, Navy standard impingement filter (NSIF), and preheater before entering the inlet plenum.

The antiblast valve protects the CBR filters from the damaging pressures generated by conventional or nuclear detonations. It employs titanium vanes that instantaneously close in response to the shock front and reopen once the shock wave has passed.

The NSIF roughing filter is housed in the intake/air-lift. It removes coarse particulates from the air stream, reduces dust loading on the CBR filters, and helps keep the inlet plenum clean. The Navy standard preheater

may be either the steam or electric type. The preheater is activated by a thermostat when the intake air is less than 42 °F or by a humidistat when intake air has greater than 70% relative humidity.

From the inlet plenum, air passes through the CBR filter system. Air enters each filter housing and passes radially through the prefilter, then the CBR filter sets, passing first through the inner high efficiency particulate arresting (HEPA) filter elements, where fine particulates and aerosols are removed, then through gas adsorbers, where gases are removed.

The filtered air leaves the CBR filter system and enters the outlet plenum; it is then pulled from the outlet plenum by high-pressure vaneaxial supply fans and pushed into ductwork for distribution throughout the TP zone. In systems equipped with cooling coils, some air is first pushed through the coils and then into the ductwork, where it mixes with the air that bypassed the coils.

Differential pressure gauges are mounted in or near the fan room to indicate the pressure drop across the NSIF and CBR filters. A damper is installed immediately downstream of each supply fan to close off weather openings when supply fans are secured and to prevent recirculation through an idle fan where dual fans are used. These dampers may also be interlocked with weapon system firing circuits to prevent missile exhaust gas from entering the CBR filters. When interlocked, the damper automatically closes for a period long enough to prevent ingestion of toxic exhaust gases during missile firings.

One or more exhaust fans per zone are used to satisfy habitability requirements and remove odors and stale air from heads, galleys, and workshops. Air from the zone flows into exhaust system ducts, then into the exhaust fan damper and out through the weather opening. In some ships, a three-position exhaust damper is installed. The damper can be manually set to the fully open, intermediate, or fully closed positions. The fully open position is for use during periods when zone pressurization is not required. The intermediate position is for use when a 2.0 in. wg overpressure is required. The fully closed position is used during emergency operation to help maintain overpressure when a minor breach in the zone boundary or a supply fan failure occurs.

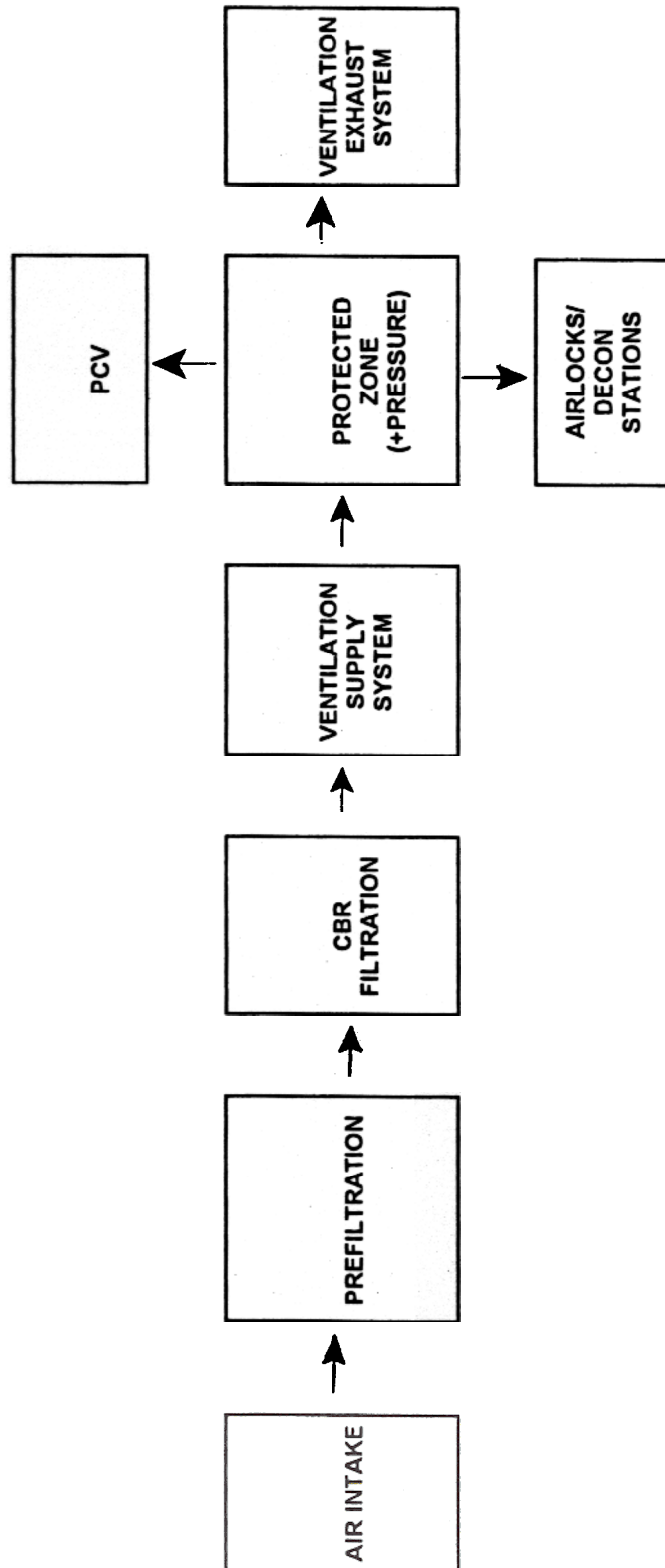
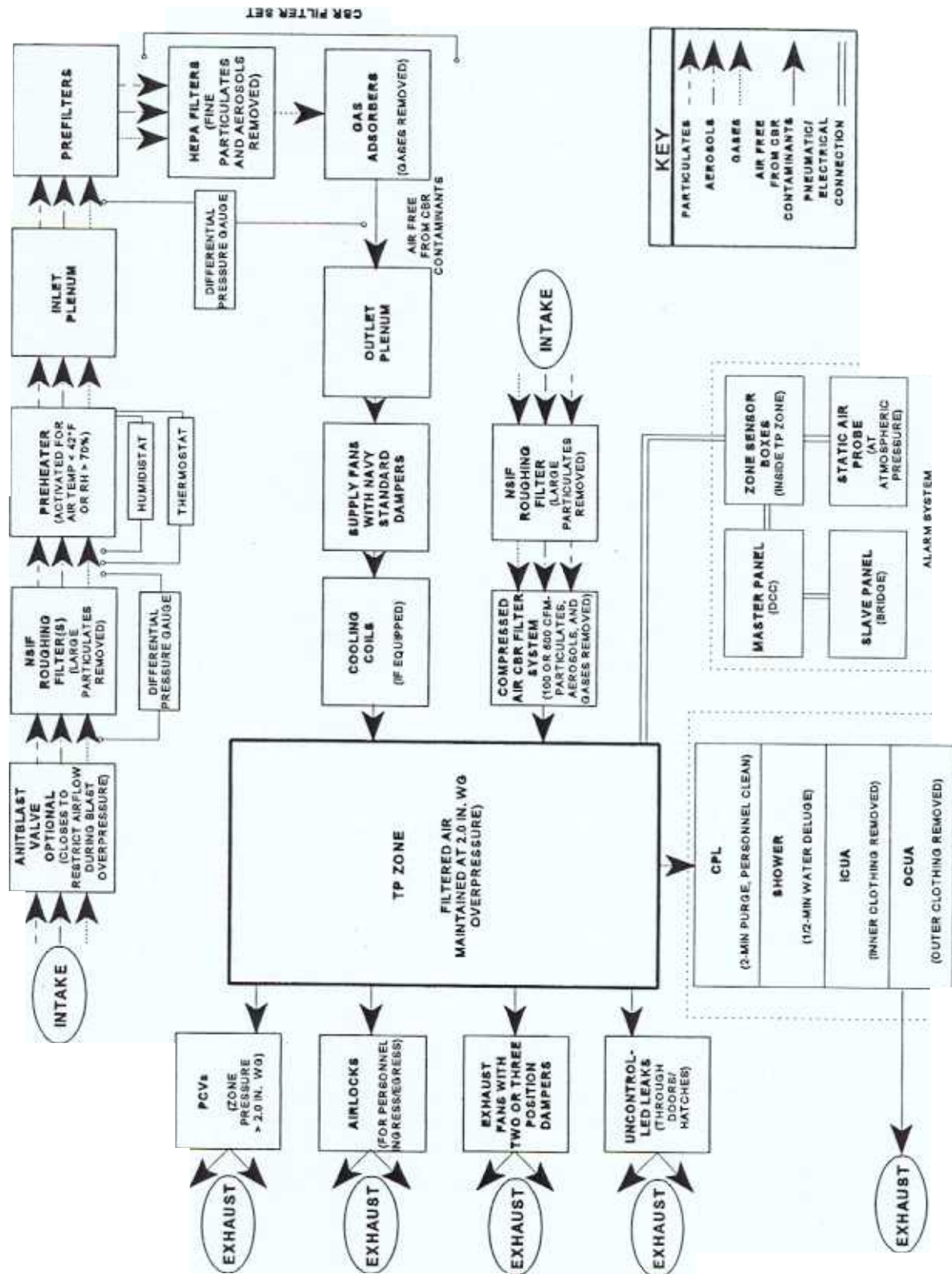


Figure 5-1. Basic Functional Flow of CPS



DECONTAMINATION STATION
(FOR PERSONNEL INGRESS AFTER CBR ATTACK)

Pressure control valves (PCVs) are used to relieve excess air to prevent zone pressure from rising above 2.5 in. wg. The valve is a mechanical device with a spring-loaded diaphragm that begins to open as zone pressure rises above 2.0 in. wg. As the valve opens, air is released to the weather or an area at atmospheric pressure.

An alarm system is used to monitor zone pressure. In each TP zone, a sensor box houses a pressure transducer that compares zone pressure to reference pressure from the static air probe and transmits to the master panel in Damage Control Central (DCC) a voltage signal proportional to zone pressure. A circuit card in the master panel processes the voltage signal and controls lamp sequencing, meter movement, and audible alarm activation. When a red lamp is energized on the master panel, electrical signals are sent to the audible alarm on the master panel and the slave panel in the Pilot House (Bridge). If the audible alarm control switch is in the ENABLE position, the alarm signal causes the alarm to emit a continuous clearly audible sound. The signal sent to the slave panel causes a corresponding zone red lamp to light on the panel.

Airlocks and pressure locks are used to maintain overpressure when personnel cross the TP zone boundary. Airlocks and pressure locks are small controlled chambers with two doors, one for entry and one for exit. To maintain overpressure and provide personnel safety, only one door should be opened at a time. Airlocks are equipped with air sweeps which, when opened, allow filtered air from the pressurized zone to flow through the airlock to outside the zone. This air sweep purges the airlock of gas hazards. A pressure lock is not ventilated and should not be used after a CBR attack.

The decontamination station provides the space for decontaminating personnel before entering the TP zone. Although the design of the decontamination station may vary, it normally consists of four spaces: outer clothing undressing area (OCUA), inner clothing undressing area (ICUA), shower, and contamination purge lock (CPL). The airflow through these spaces is arranged to provide a continuous sweep, to prevent aerosol and vapor contamination from entering the zone. During threat conditions, contaminated personnel first enter the

OCUA. The OCUA, which has direct access to weather, is where the outer clothing is removed. The OCUA may contain both liquid and gas hazards. The person then enters the ICUA, where remaining clothing, except the gas mask, is removed. Gas hazards, as well as low-level contact hazards, may exist in the ICUA. After exiting the ICUA, the person enters the shower, where any remaining contaminants are washed from the body during a 30-sec deluge shower. Finally, the person enters the CPL, where any remaining gases are removed after a 2-min air purge. Only after passing through these four chambers may the person enter the TP zone.

Compressed air supplies serving protected zones are also equipped with CBR filtration. One of two systems may be used: a 100-cfm CBR filter system or a 600-cfm CBR filter system. The 100-cfm system consists of an NSIF roughing filter, coupled with a CBR element (M-48) that filters both aerosols and gases. The 600-cfm system is a single CBR filter assembly, consisting of one housing and three CBR filter sets. The CBR system is connected in the air intake duct upstream of the compressor.

5-3.2 LP Zones. Figure 5-3 shows the functional flow of an LP system, which is used only in machinery spaces. The LP system uses the LP HEPA filter system to remove particulate and aerosol contaminants from intake air. The LP HEPA filter system does not remove gases; therefore, personnel in LP zones must wear protective masks during a CBR attack.

After entering through a weather intake, air for the LP system passes through an antiblast valve, NSIF roughing filter, and possibly an LP prefilter, where coarse particulates and aerosols are removed. The air then passes through the LP HEPA filters, where fine particulates and aerosols are captured. Navy standard vaneaxial fans pull air through the filters and push it into the LP zone. These fans are not the high-pressure type used for TP zones, and they do not pressurize the LP zone. Air is removed from the zone and exhausted back to the weather by Navy standard vaneaxial fans.

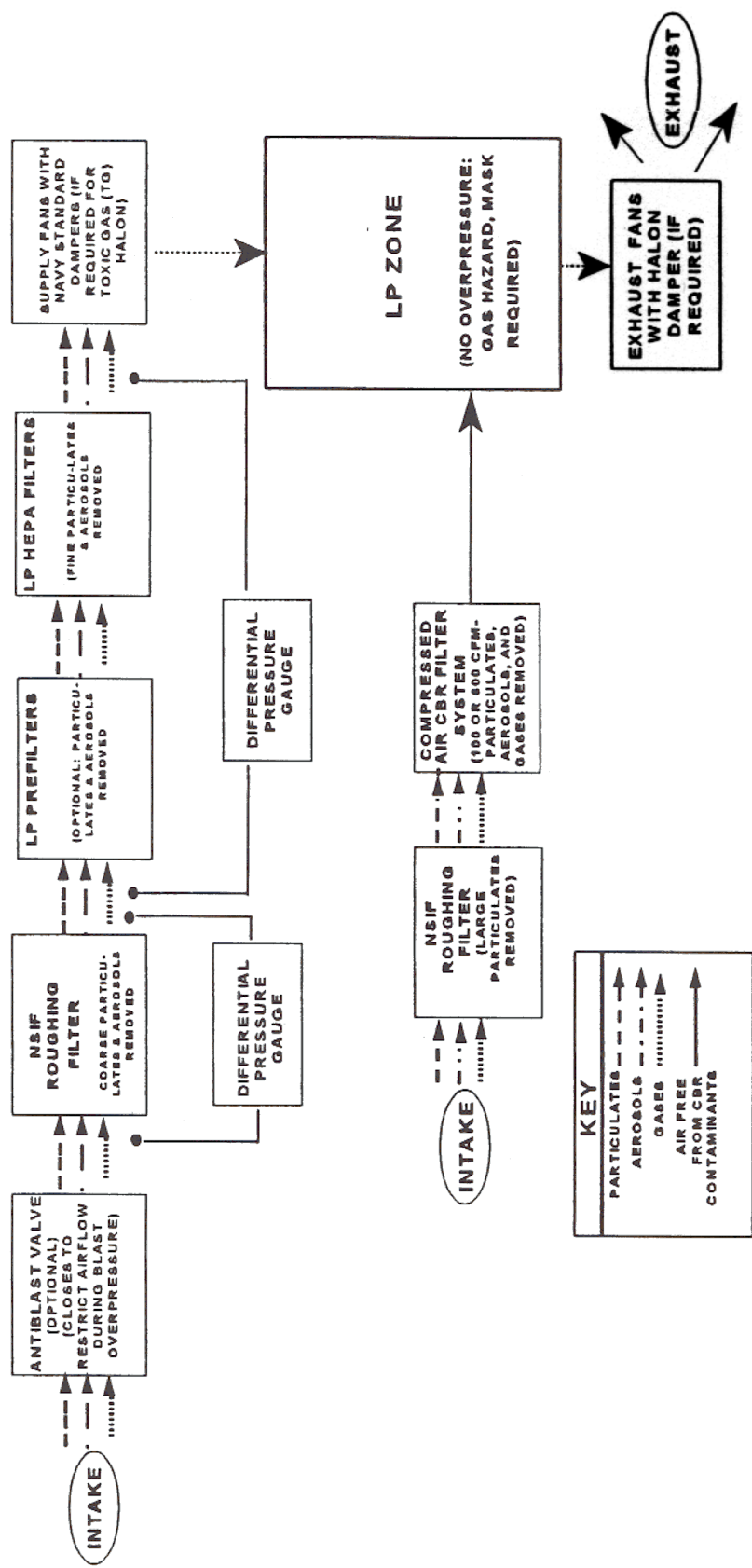


Figure 5-3. Functional Flow of Limited Protection CPS

CHAPTER 6 SCHEDULED MAINTENANCE

6-1 INTRODUCTION.

This chapter identifies all scheduled maintenance actions for the Navy Shipboard Collective Protection System (CPS). CPS scheduled maintenance includes both organizational and intermediate maintenance; no depot-level maintenance is required.

6-2 ORGANIZATIONAL-LEVEL SCHEDULED MAINTENANCE.

Organizational-level scheduled maintenance instructions for CPS are furnished in the Planned Maintenance System (PMS). Table 6-1 lists the organizational-level scheduled maintenance actions to be performed.

Removal, inspection, and installation of prefilters at the organizational level should not be accomplished if the filter system has been subjected to a chemical, biological, and radiological (CBR) attack. A contaminated filter system should only be serviced by specially trained mobile teams.

Procurement information for the bag plus flat prefilter can be found in the CPS CBR Filter System Technical Manual, SS200-AG-MMM-010.

Procurement information for the limited protection (LP) high efficiency particulate arresting (HEPA) filters is as follows:

Filter, HEPA, 2000 cfm at 1.35 in. wg
Model No. 1XT-242412-1DS
Part No. 49745G016

The recommended supplier is:

Farr Company
2221 Park Place
El Segundo CA 90245
Phone: (310) 536-6300
(800) 333-7320
Fax: (310) 643-9086

6-2.1 Calibration of Gauges. Several types of gauges are used with CPS. Differential pressure gauges are mounted near the Navy standard impingement filter (NSIF) roughing filter, CBR filter system, compressed air filter system, and limited protection (LP) high efficiency particulate arresting (HEPA) filter system. These gauges measure pressure drop across the respective filters, providing an indication of airflow resistance. All CBR filter and LP HEPA system gauges are considered critical for calibration purposes. The recommended calibration interval is every 2 yr. NSIF and compressed air gauges are not critical measurements and do not require calibration.

Throughout each total protection (TP) zone and near airlocks, zone pressure gauges are installed to provide local indication of zone pressure. Due to environmental variations, these gauges may not reflect the true zone pressure. They are used for reference only and are not critical for calibration purposes. However, zone pressure gauges located in the alarm system sensor box and Damage Control Central (DCC) show true zone pressure, and are considered critical for calibration purposes. The recommended calibration interval is every 2 yr.

Calibration of differential pressure gauges should be performed every 24 months in accordance with NAVSEA OD 45845, using approved calibration procedures NAVAIR 1720, MP-16, MP-41, or MP-164.

6-3 INTERMEDIATE-LEVEL SCHEDULED MAINTENANCE.

Table 6-2 lists the intermediate-level scheduled maintenance actions, identifies the performance intervals (periodicity), and provides a cross-reference to the applicable instructions.

Table 6-1. Organizational-Level Scheduled Maintenance Actions

Perform zone pressurization test
Inspect static air probe/zone sensor box condensate drain traps/pressure control valves (PCVs)/airlock door safety latches/zone and filter pressure gauges/airlock light system
Report all discrepancies to Work Center Supervisor (WCS)
Inspect decontamination station
Remove prefilter/Install new prefilter/Submit work request to Intermediate Maintenance Activity (IMA)
Inspect limited protection (LP) high efficiency particulate arresting (HEPA) filters
Replace limited protection (LP) high efficiency particulate arresting (HEPA) filters

Table 6-2. Intermediate-Level Scheduled Maintenance Actions

Periodicity	Maintenance Action	Reference
36 Months	Replace CBR filters (including compressed air CBR filters) and prefilters*	Equipment Manual SS200-AG-MMM-010
36 Months or as required	Perform CBR filter system leak test (TP/LP): a. at initial installation; b. after every new filter install:	Equipment Manual SS200-AG-MMM-010 ASME N510-1989 Reaffirmed 1995
As required	- TP System - LP System	

* New set of CBR Prefilters shall be provided during CBR filter set installation.

CHAPTER 7 TROUBLESHOOTING

INTRODUCTION.

This chapter provides the information needed to isolate system-level operational faults. It includes an operation-based symptom fault directory cross-referenced to fault logic diagrams and fault isolation procedures.

CPS FAULT DIRECTORY.

Table 7-1 is an operation-based symptom fault directory for the Navy Shipboard Collective Protection System (CPS). It relates the fault isolation procedures and diagrams in this chapter to system faults observed during CPS operation, and provides a cross-reference index of operational, functional, troubleshooting, and alignment procedures. The information is provided under the following column heads:

- a. **Operating Procedure Step:** This column lists those steps of the operation procedures in Chapter 4 for which a fault symptom can be observed.
- b. **Functional Description:** This column provides a brief description of the system malfunction.
- c. **Fault Isolation Procedure:** This column references the paragraph number of the applicable fault isolation procedure in this chapter.
- d. **Alignment Procedure:** This column references the paragraph number of the applicable alignment procedure in Chapter 8 of this manual.
- e. **Fault Logic Diagram:** This column references the figure number of the applicable fault logic diagram contained in this chapter.
- f. **Equipment Document:** This column references the number of any applicable equipment manuals.

7-3 FAULT LOGIC DIAGRAMS.

Figures 7-1 through 7-3 are system-level fault logic diagrams based on fault indications observed during CPS operation. Each diagram consists of a group of question and conclusion boxes. Question boxes (shaded) concern system status measurement and result in a *yes* or *no* answer. This process continues, progressively narrowing the possibilities, until the fault has been isolated. Conclusion boxes (double-lined) then list the probable source of the fault, and reference the applicable procedure(s) and/ or appropriate technical manual to be consulted.

7-4 FAULT ISOLATION PROCEDURES.

The procedures below will enable the user to isolate faulty CPS equipment. These procedures support the fault logic diagrams in figures 7-1 through 7-3. A work request should be submitted if these procedures cannot restore CPS to a fully functional status.

Table 7-1. Symptom Fault Directory

Operating Procedure Step	Functional Description	Fault Isolation Procedure	Alignment Procedure	Fault Logic Diagram	Equipment Document
4-3.1c	Low zone pressure	7-4.1	8-2	7-1	Ship Information Book (SIB) NAVSEA SS200-AG-MMM-010
4-3.1c	High zone pressure	7-4.2	8-3	7-2	SIB NAVSEA SS200-AG-MMM-010
4-3.1c	High zone pressure	7-4.2	8-3	7-2	SIB NAVSEA SS200-AJ-MMM-010
4-3.2	Alarm system green indicator lamp not lit	7-4.3	8-4	7-3	NAVSEA SS200-AH-MMM-010

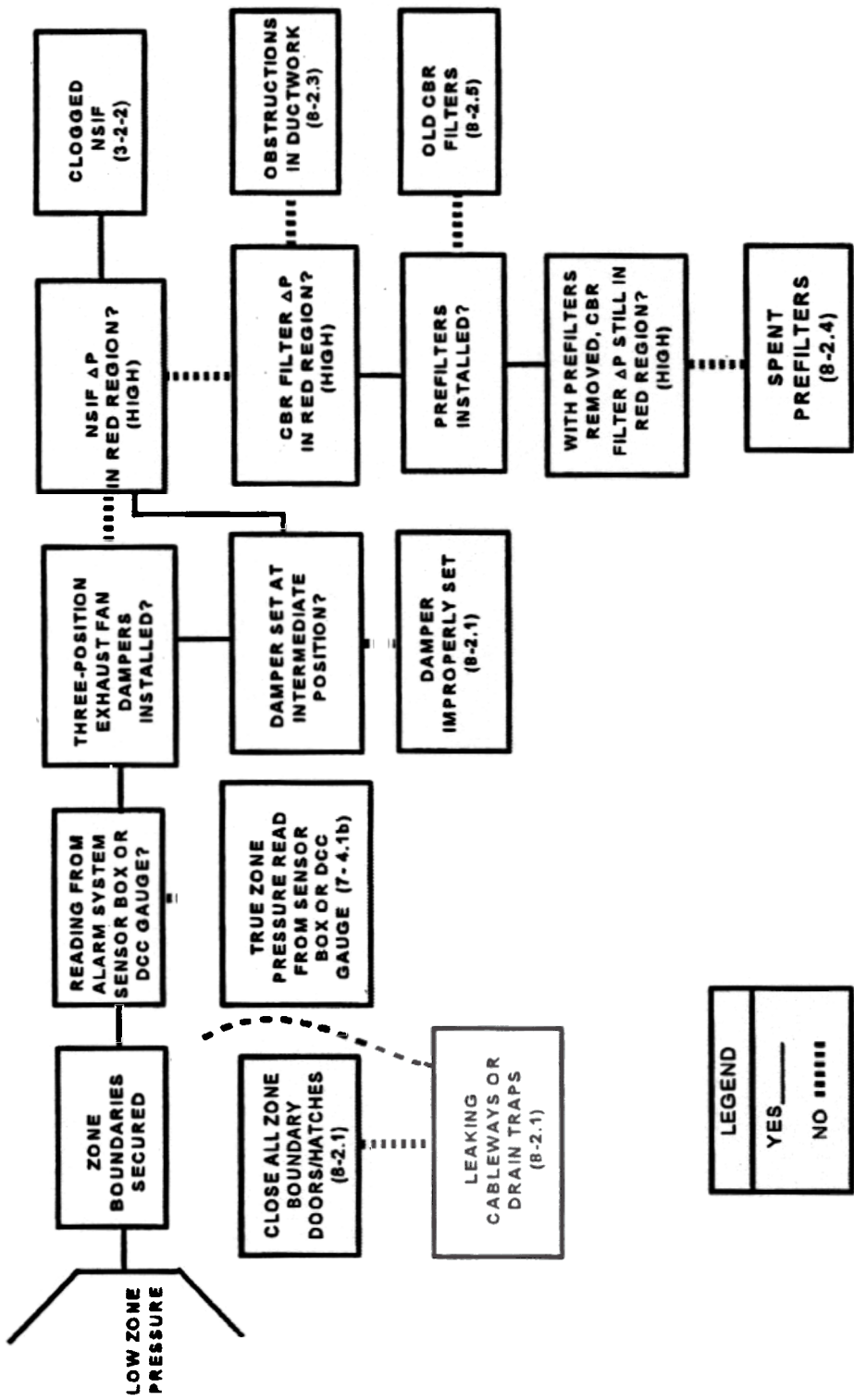


Figure 7-1. Fault Logic Diagram #1

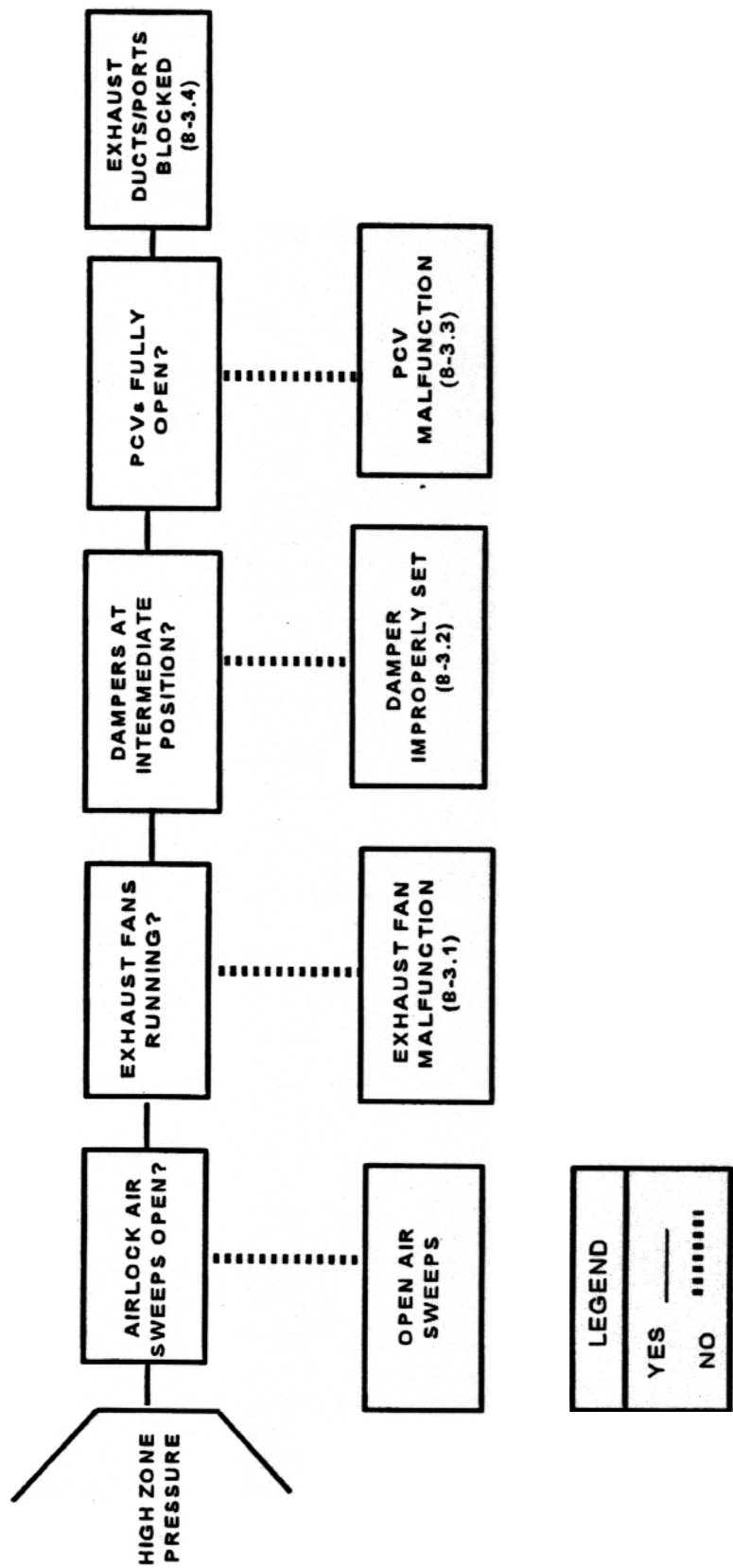


Figure 7-2. Fault Logic Diagram #2

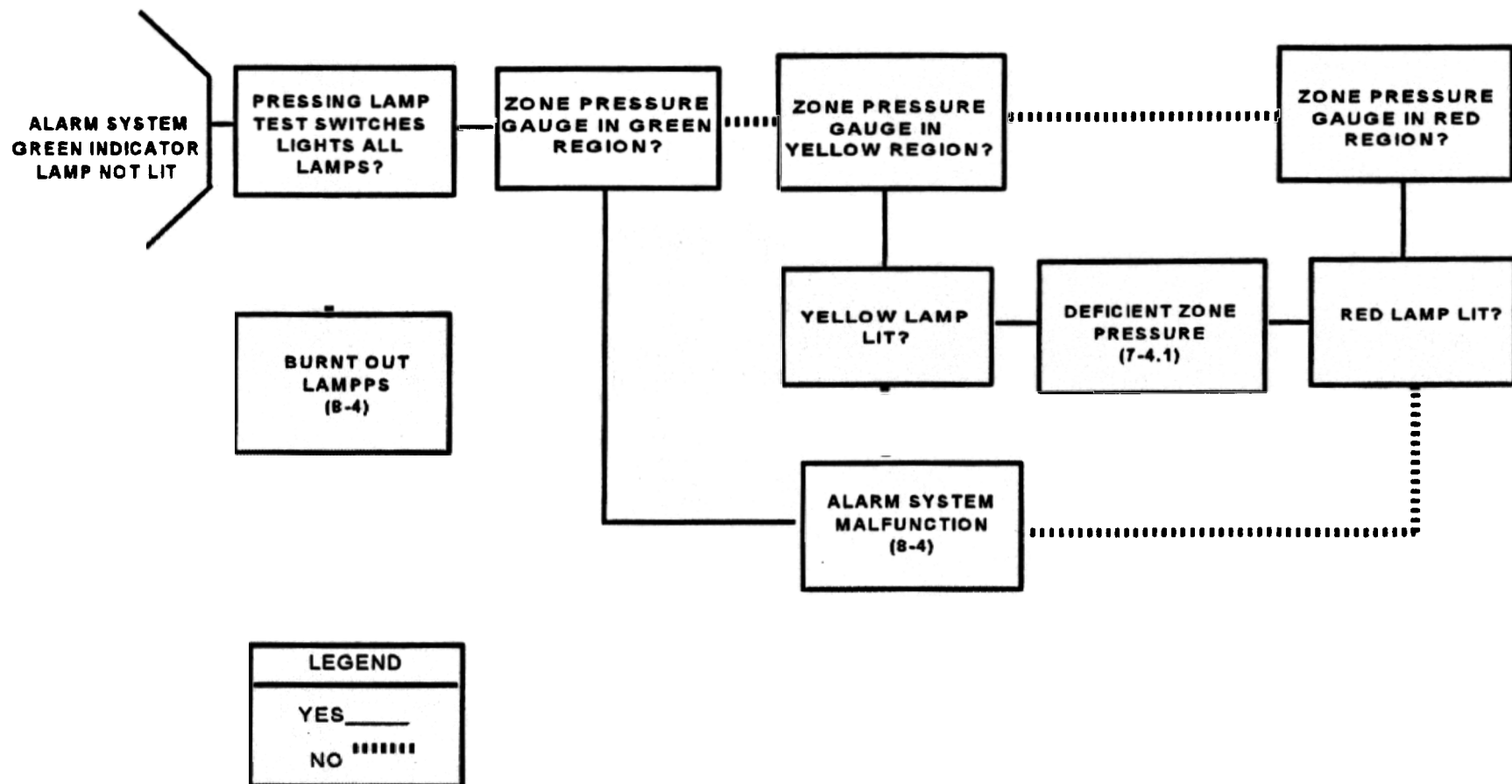


Figure 7-3. Fault Logic Diagram #3

7-4.1 Low Zone Pressure. Perform the fault isolation procedures below if zone pressure in a total protection (TP) zone falls below 1.5 in. wg.

- a. Check for leaks at zone boundary as follows. If found, refer to alignment procedures of 8-2.1.

NOTE

Zone boundaries are detailed in the Ship Information Book (SIB).

- (1) Ensure all fittings, such as doors, scuttles, hatches, windows, etc. are closed.
- (2) Locate and repair unsealed cableways, waveguides, and other holes that may have been cut in zone boundary to install new equipment.
- (3) Ensure all drain traps are filled with water. (If supply and exhaust fans were not started simultaneously, water in the drain traps may have been displaced).
- b. Ensure zone pressure is being read from the alarm system zone sensor box or the gauge in Damage Control Central (DCC). Only these gauges provide true zone pressure.
- c. Check exhaust fan dampers; three-position dampers (if equipped) should be set at intermediate position; Navy standard dampers should be fully open.

NOTE

The following procedures must be performed with the TP zone pressurized.

- d. Check Navy standard impingement filter (NSIF) roughing filter differential pressure gauge:
 - (1) If gauge reading is in red region, renew or replace filter installed in intake/airlift (8-2.2).
 - (2) If gauge reading is in green region, continue with step e below.
- e. Check chemical, biological, and radiological (CBR) filter pressure differential gauge(s):
 - (1) If gauge is below red region, intake/airlift ductwork may be obstructed; see 8-2.3.

- (2) If gauge is in red region, continue with step f below.

- f. Enter inlet plenum. Remove prefilters from all CBR filter housings and place outside inlet plenum.
- g. Exit plenum, and close and dog door.
- h. Recheck CBR filter differential pressure gauge:
 - (1) If gauge reading dropped below red region, replace prefilters (8-2.4).
 - (2) If gauge reading is still in red region, replace CBR filters (8-2.5).

7-4.2 High Zone Pressure. Use the fault isolation procedures below if the overpressure in a TP zone exceeds 2.5 in. wg.

- a. Ensure airlock air sweep fittings are open.
- b. Check exhaust fans:
 - (1) Ensure fan(s) are running properly (8-3.1).
 - (2) Ensure damper(s) are properly set (8-3.2).
- c. Check pressure control valve (PCV) operation (8-3.3).
- d. Check CPS exhaust ducts/ports for blockages (8-3.4).

7-4.3 Alarm System Green Indicator Lamp Not Lit. Use the fault isolation procedures below if the appropriate green indicator lamp on the alarm system master panel does not light when a TP zone is pressurized.

- a. Press lamp test switches on master panel and slave panel:
 - (1) Replace bulb (8-4) on any lamp that remains unlit, and retest.
 - (2) If all lamps light, continue with step b.
- b. Check zone pressure:
 - (1) If pressure is greater than 1.5 in. wg, alarm system is malfunctioning (8-4).
 - (2) If pressure is between 0.4 and 1.5 in. wg, only yellow lamp should be lit, indicating low zone pressure. If not, alarm system is malfunctioning (8-4).
 - (3) If pressure is less than 0.4 in. wg, only red lamp should be lit, indicating no zone pressure. If not, alarm system is malfunctioning (8-4).

CHAPTER 8

ALIGNMENT PROCEDURES

8-1 INTRODUCTION.

This chapter provides the information needed to correct system-level faults. If a malfunction can be isolated to a specific equipment, the user is referred to the appropriate equipment technical manual.

8-2 CORRECT LOW ZONE PRESSURE

8-2.1 Repair Leaks at Zone Boundary. If any fittings, holes, dampers, etc., do not remain secured, they must be repaired in accordance with the Ship Information Book (SIB).

NOTE

Zone boundaries are detailed in the SIB.

8-2.2 Renew Navy Standard Impingement Filter (NSIF). Renew NSIF in accordance with maintenance requirements specified in the Ship's Planned Maintenance System (PMS). The NSIF may be renewed at the organizational level.

8-2.3 Remove Obstructions in Ductwork. Obstructions to ventilation supply airflow are most likely to be found in the weather air intake/airlift, antiblast valve, preheater, or the outlet plenum at the duct entrance to the fan. Check all ductwork upstream and downstream of the supply fan, as well as both the inlet and outlet plenums, for any foreign matter that could block airflow.

8-2.4 Replace Prefilter(s). Replace prefilter in accordance with the procedures provided in NAVSEA Technical Manual SS200-AG-MMM-010. These prefilters are replaced at the organizational level.

8-2.5 Replace Chemical, Biological, and Radiological (CBR) Filters. CBR filter replacement should be performed by an Intermediate Maintenance Activity (IMA). If required in an extreme situation, the ship may choose to replace only **damaged** filters (i.e., damage by fire, flooding, etc.). Procedures for CBR filter

change-out are provided in NAVSEA Technical Manual SS200-AG-MMM-010. When installed, CBR filters must be tested by an Intermediate Maintenance Activity (IMA) to ensure that no leak paths exist through or around the filters. Gas and high efficiency particulate arresting (HEPA) cover knobs are tightened to specification; do not remove either, as doing so could void the leak-tight integrity of the filter bank.

8-3 CORRECT HIGH ZONE PRESSURE.

8-3.1 Check Exhaust Fan Operation. If high zone pressure is caused by malfunctioning exhaust fans, consult the appropriate commercial manual or the SIB.

8-3.2 Check Dampers. Check that the dampers are set to the proper position. If three-position dampers are set to the fully closed position, high zone pressure will result; if set to the fully open position, low zone pressure will result. During normal operation, three-position dampers should be set to the intermediate position and Navy standard dampers should be fully open.

8-3.3 Adjust/Repair Pressure Control Valve (PCV). If high zone pressure is caused by PCV malfunction, consult NAVSEA Technical Manual SS200-AJ-MMM-010. Adjustment or repair may be accomplished at the organizational level.

8-3.4 Clear Exhaust Ducts/Ports. If high zone pressure cannot be eliminated by repairing or adjusting the exhaust fans or PCVs, check all exhaust ducts and ports for blockage. Also check that air sweeps on airlocks and in the decontamination station are unobstructed.

8-4 REPAIR ALARM SYSTEM MALFUNCTION.

Procedures for replacing faulty bulbs or to further isolate alarm system malfunctions are contained in NAVSEA Technical Manual SS200-AH-MMM-010. The authorized level of repair will be dictated by the nature of the malfunction.

APPENDIX ABBREVIATIONS AND ACRONYMS

	Chemical, Biological, and Radiological
cfm	Cubic Feet Per Minute
	Contamination Purge Lock
	Chemical Protective Overgarment
	Collective Protection System
DC	Damage Control
	Damage Control Central
	High Efficiency Particulate Arresting
	Inner Clothing Undressing Area
	Intermediate Maintenance Activity
wg	Inches of W ater, Gauge
	In-Serv E ngineering Agency
LP	Limited Protection
	Minimum Functional Status
NAVSEA	Naval Sea Systems Command
NSWCDD	Naval Surface Warfare Center Dahlgren Division
	Naval Publications and C enter
NS DSA	Naval Sea Data Support Activity
	Navy Standard Impingement Filter
NSWSES	Naval Ship W apon E ngineering Station
OCUA	Outer Clothing Undressing Area
	Pressure Control V alve
	Planned Maintenance System
SIB	Ship Information Book
	Total Protection

SS 00 AF MM 0 0 NAVY SH PBOARD COLLECTIVE PROT CT'ON SYSTEM CPS